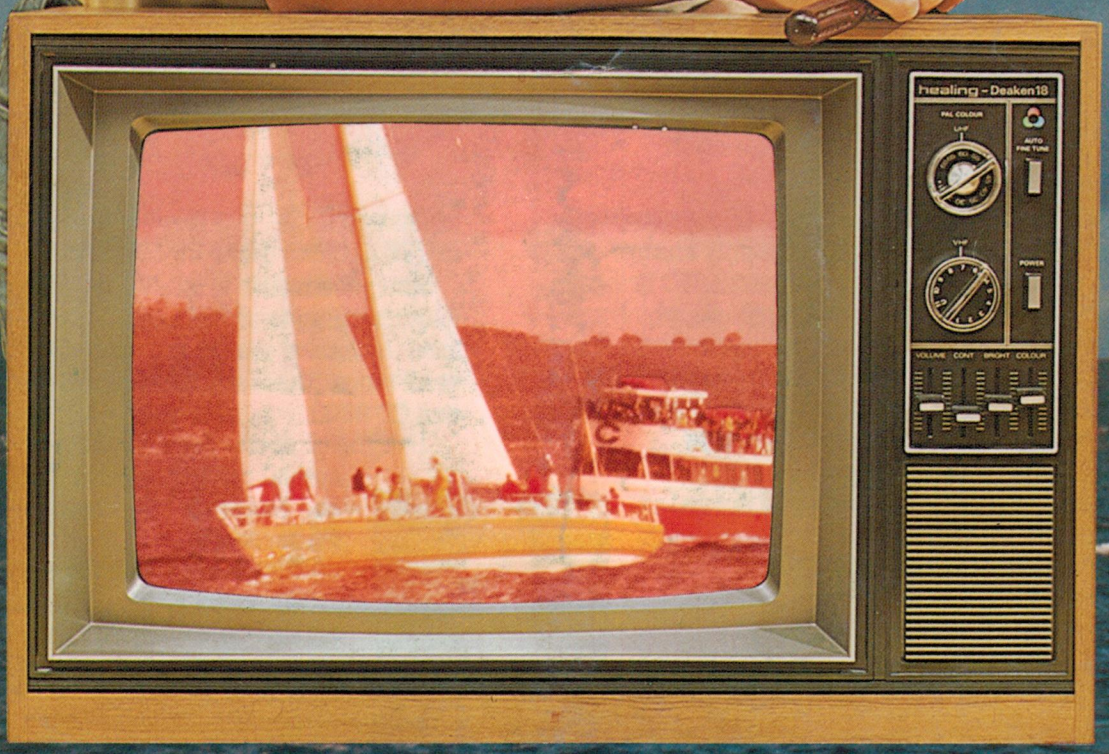
FEBRUARY 1977 $1.00*
NZ $1.10

electronics TODAY

HOW I^2L WORKS

32 PAGES
CB
AUSTRALIA
FREE
INSIDE



Registered for posting as a publication — Category C

TUNE-UP YOUR COLOUR TV

Well stacked in front

The new range of JVC front-loading cassettes is here. And if you think that's the only change, you're highly mistaken. Because, as usual, JVC brings in the range with a few unique additions which are going to make you think twice about any other brand.

For a start, the JVC ANRS sound reduction system is incorporated throughout, to make hi fi recording and playback as free of hiss as possible. And in some cases, even improving the dynamic range of normal cassettes.

Another exclusive is the JVC Sen-alloy head, and believe it or not, it offers you the clearest sound and longest wearing lifespan of any head available; originally designed solely for professional use, this head is now incorporated in JVC cassette decks CD-S200 and CD-1970.

And yet another first: JVC is the only manufacturer to provide decks with 5 LED peak-level indicators so that your recordings are perfect at all times. These are featured on models CD-1920 and CD-S200.

Loading is, of course, simplified. The special compartment is air-damped and removable for uncramped head maintenance.

The JVC famous range of top-loaders is still available, offering you the very highest quality. All things considered, there is no other consideration.

JVC

the right choice

For details on JVC Hi Fi Equipment, write to: JVC Advisory Service, P.O. Box 49, Kensington, N.S.W. 2033.

electronics TODAY INTERNATIONAL

A MODERN MAGAZINES PUBLICATION

FEBRUARY 1977, Vol. 7 No. 2

Editorial — Steve Braidwood
Publisher — Collyn Rivers

Electronics Today International is Australian owned and produced. It is published both in Australia and Britain and is the fastest growing electronics magazine in each country.

COVER: *After spending hundreds of dollars on a colour TV most people think the bright colours are fantastic – so fantastic that months after the purchase they still have the colour control up full and all the other controls out of place. On page 16 we tell you how to set up the set for what we consider the best picture.*

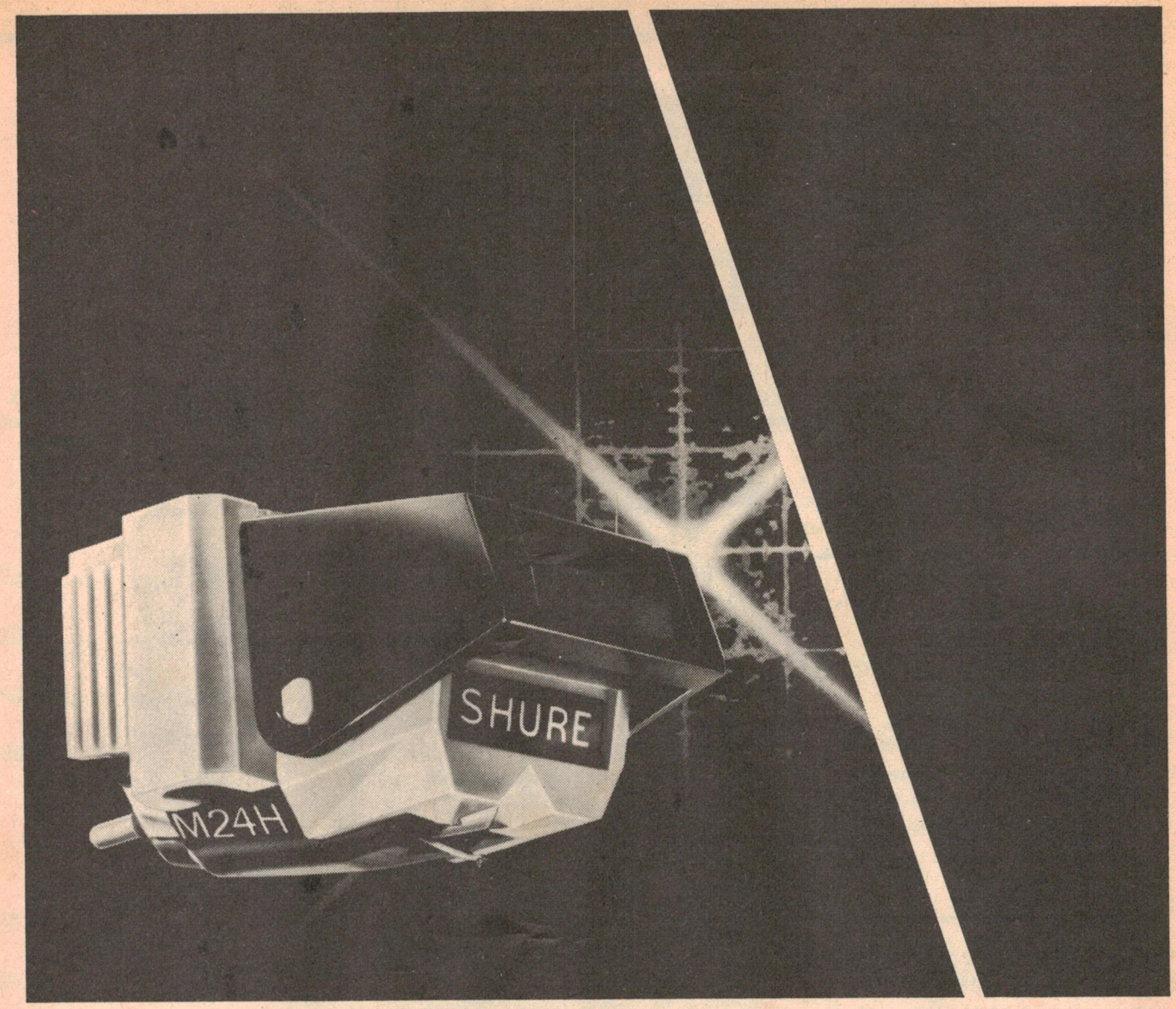
***Recommended retail price only**

PROJECTS

FEATURES

NEWS & INFORMATION

FREE INSIDE 32 page magazine, CB AUSTRALIA



Uncompromised stereo/quadriphony —Undeniably Shure.

2+4

MODEL M24H
STEREO +
QUADRIPHONIC
CARTRIDGE

The new Shure M24H Cartrtidge offers audiophiles the best of both worlds: It is the only cartridge on the market that does not comprise stereo reproduction to add discreet quadriphonic capability. It eliminates the need to change cartridges every time you change record formats! This remarkable performance is achieved at only 1 to 1½ grams tracking force — comparable to that of the most expensive conventional stereo cartridges. Other M24H features include the lowest effective stylus mass (0.39 mg) in quadriphony, a hyperbolic stylus tip design, an exclusive "Dynetic® X" exotic high-energy magnetic assembly, and a rising frequency response in the supersonic carrier band frequencies that is optimized for both stereo and quadriphonic re-creation. If you are considering adding CD-4 capability, but intend to continue playing your stereo library, this is the ONE cartridge for you.

Distributed in Australia by
AUDIO ENGINEERS PTY. LTD.
342 Kent Street, Sydney. Write for catalogue.

SHURE®

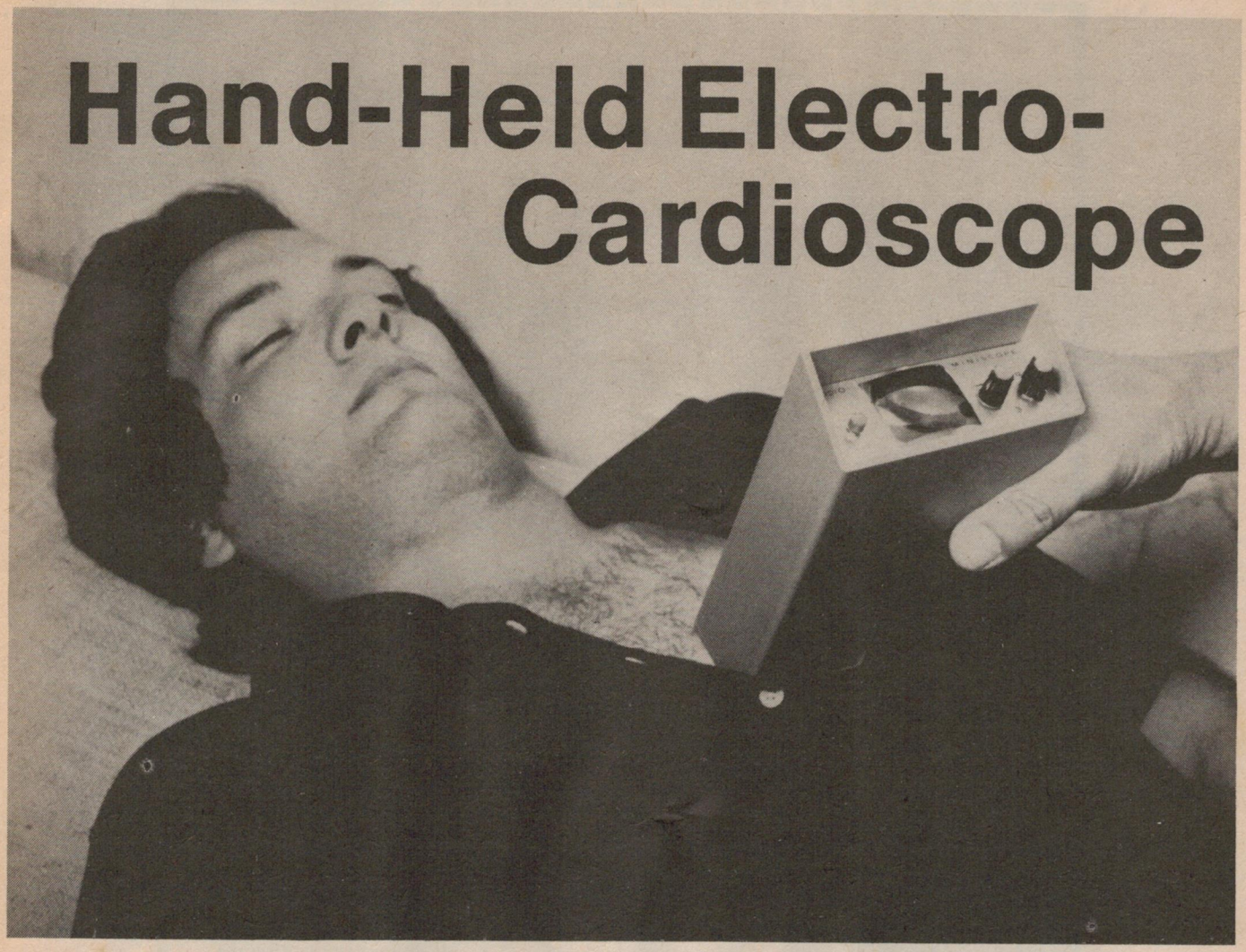
AUDIO ENGINEERS (Vic.)
2A Hill Street,
THORNBURY. 3071. Vic.

AUDIO ENGINEERS (Qld.)
57 Castlemaine Street,
MILTON. 4064. Qld.

ATHOL M. HILL PTY. LTD.
33-35 Wittenoom Street,
EAST PERTH. 6000. W.A.

NEWS DIGEST

Hand-Held Electro-Cardioscope



The Cardio Miniscope is a new battery-operated electro-cardioscope introduced by Vitalograph Limited.

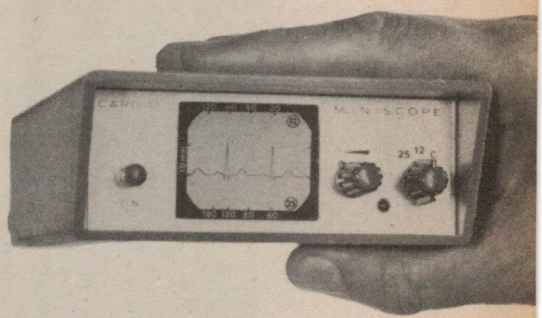
The Cardio Miniscope has integrated electrodes and measures only 4.5x11x18 cm and weighs 790g. It is the most compact unit of its type on the world market. The miniature cardioscope is simply placed on a patient's chest to provide an "instant" ECG. No electrodes need to be attached to the patient and no power lines are plugged in, thus saving time when seconds may be precious.

The Cardio Miniscope displays an ECG tracing which is approximately equivalent to that resulting from the pre-cardial or second Einthoven extremity/thoracic lead. It allows a trained professional to differentiate between a normal ECG, "weak heart" action, fibrillation and asystolia.

The screen size is 33x37mm.

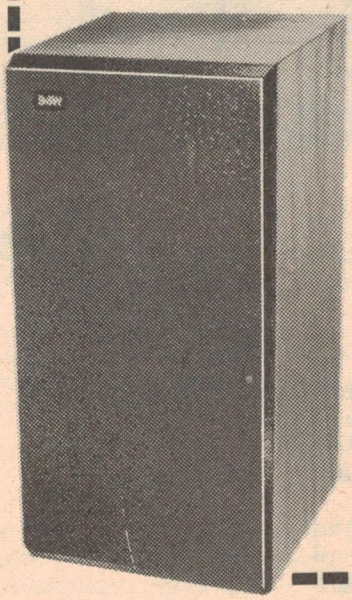
The sturdy unit is designed for both routine and emergency use. It can easily be used at the scene of an accident (especially electric shock), or for mass cardiac screenings.

The Cardio Miniscope is claimed to have unparalleled simplicity of operation. After pressing the 'start' button, the operator simply moistens the electrode surface at the base of the instrument (with water, electrode fluid or saliva), places the unit on the patient's bare chest (to the left of the sternum) and reads the ECG tracing.



The Cardio Miniscope switches off automatically after one minute to prevent premature battery drain. The start button, however, may be pressed as often as required. Thus, re-examination to monitor the effectiveness of therapeutic measures is easy. Freedom from having to plug into power lines means the unit is intrinsically shockproof.

Think small.



Is space your problem?
Think B&W DM5 loudspeakers. Only 18" x 9" x 9½"

Despite its compact size, B&W's DM5 speakers can be rated as a system of very high quality. This is what the experts say:

Electronics Australia, Oct. '76 . . . "Listening tests confirm the supplied frequency response curves. It is very smooth and well maintained up to the limit of audibility . . ." Stereo Buyers' Guide says . . . "The DM5 mid ranges are excellent, being smooth with a nice bite to them and the highs are well maintained and shimmering in quality . . . "
Stereo Magazine Issue 13 . . . "The DM5 is a fine, well crafted speaker of modest dimensions and price but with a standard of performance that belies both those parameters . . . the mid range response is clear and possessing a lifelike presence that left us most impressed.

Have your B&W dealer demonstrate to you the fine qualities of the DM5 . Recommended retail price $299.00

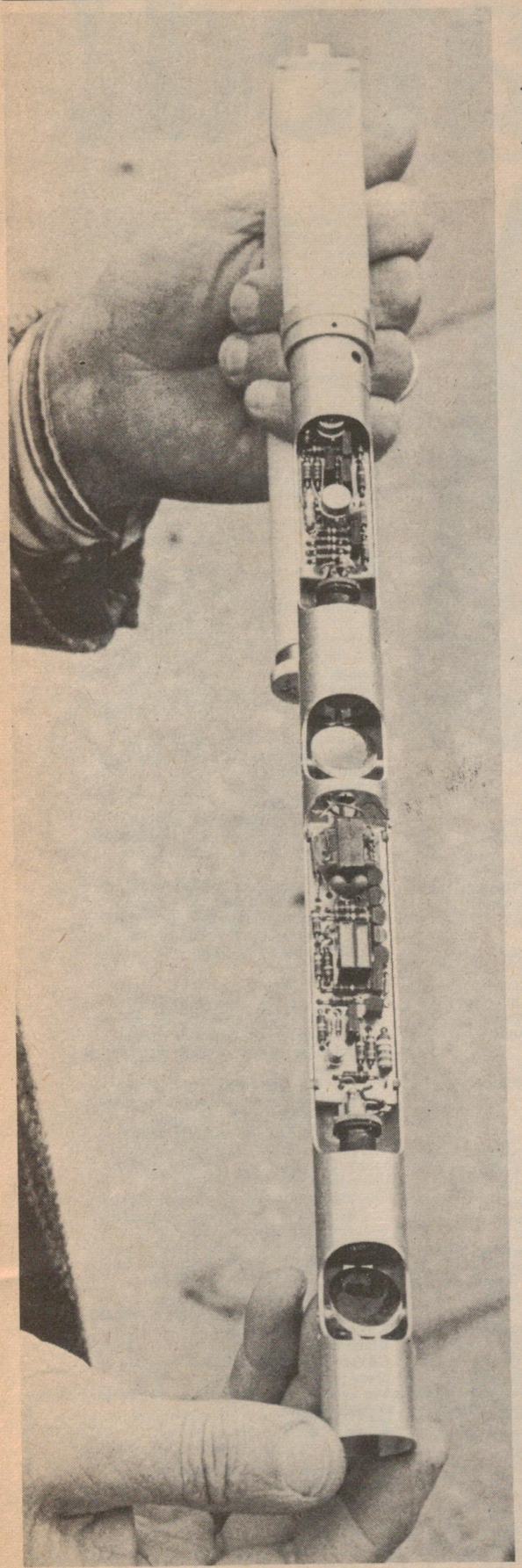
B&W LOUDSPEAKERS

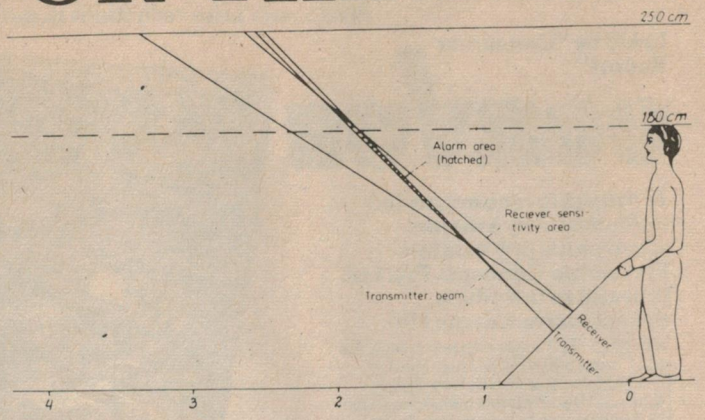
Sole Australian agent:

Convoy INTERNATIONAL 4 Dowling Street Woolloomooloo 2011 357-2444

VICTORIA: Allans Music (Aust) Ltd. 63 0451 Encel Electronics Pty. Ltd. 42 3761 Instrol Hi-Fi (Vic) Pty. Ltd. 67 5831 Southern Sound 67 7869 Southern Sound, Moorabbin 97 7245 Tivoli Hi-Fi 81 2872 Buy-Rite Electrix 42 6000 E & B Wholesale (Geelong) 9 6616 The Sound Craftsman 509 2444. **N.S.W.:** Convoy Sound W'Loo showroom 357 2444 Convoy Sound City showroom 29 1364 The Gramophone Shop 633 2846 Instrol Hi-Fi Pty. Ltd. 290 1399 Milverson Pty. Ltd. Chatswood 412 2122 Milverson Pty. Ltd. Parramatta 635 3588 Riverina Hi-Fi 938 2663/4 United Radio Distributors P/L 232 3718 Wests (Burwood) Pty. Ltd. 747 4444 Arrow Electronics Pty. Ltd. 29 8580 Jock Leate Camera & Hi-Fi Stores Pty. Ltd. 579 6399 Pitman's Radio & T.V. Wagga 25 2155 **QUEENSLAND:** John Gipps Sound 36 0080 Premier Sound Rockhampton 28 2701 **TASMANIA:** Bel Canto 34 2008 **WESTERN AUSTRALIA:** Audio Distributors 31 5455 **A.C.T.:** Pacific Stereo 95 0695 Duratone 82 1388 **SOUTH AUSTRALIA:** Sound Spectrum 223 2181 Blackwood Sound Centre 278 1281 Decibel 61 1865 Allans Music (Aust) Pty. Ltd. 223 5533.

LASER CANE FOR THE BLIND





FOA cane – optical diagram (2-dimensional)

A new, miniature laser transceiver unit — small enough to fit in the top of a cane used by blind people has been developed by the Swedish Defence Institute (FOA).

The Laser can be made to operate in a way that is quite analogous to the blind stick. Just as the end of the stick, when encountering the resistance of any object transmits the information to the hand holding it, so the new device can be set to beam over an area to pick up any reflections from objects. The new Swedish stick — a development from an American original — has a sound signal to warn a sightless user.

There is an important difference between the stick and the laser — the laser is capable of relaying a far larger quantity of information than the traditional blind stick. It acts like a stick of variable length which a blind person can use to tap on objects several yards away from him — or immediately in front of him — both being registered by the reflection of the narrow, weightless beam of light.

SSTV by phone

Robot Research of San Diego manufacture a scan convertor (Robot Series 500) which interfaces a CCTV system to the phone line. The system takes a complete frame from the CCTV set-up every eight seconds. This picture is then converted to audio for the phone line and a system at the other end reconstructs the picture in memory. The new picture then replaces the old picture on the monitor. It is not clear whether the new picture slowly replaces the old one continuously (ie, the receiver can store only one picture), or whether there is a sudden switch from one picture to the next (which would require twice the memory). The system is designed for the US TV standard.

'Up the pole' Winner

The winner of our cartoon caption contest is S. R. King of New Lambton Heights, NSW. Mr King wins a trip to the South Magnetic Pole, courtesy of Dick Smith. The winning caption is: "How about that! Not a Tandy store in sight".

JAPAN EXPORTS MAY HIT $1,200M

Japanese exports of computer and related products could grow to $1,200 million by 1985 according to supply-demand forecast on industrial electronics published by the Electronics Association of Japan.

It is forecasted that computer-related products would dominate with 73% of total industrial electronic production by 1985 and 48% of all industrial electronics exports from Japan.

No. 1 rated!

Please note price reductions despite devaluation.

In US by "Consumer Report"

CORVUS

Thoroughly recommended in Australia by a major electronics publication. Electronic Concepts Pty. Ltd. is proud to introduce the exclusive Corvus 500.

Wtih MOSTEK* single chip technology, the new Corvus 500 is the first non-Hewlett-Packard calculator with Reverse Polish Notation. 10 addressable memories, 4 level roll down stack to be introduced. If you compare the Corvus 500 feature by feature with the HP45, you will find striking similarities. There are also some important differences.

MOSTEK is one of America's advanced LSI (Large Scale Integration) chip manufacturers.

	Corvus 500	HP 45
RPN (Reverse Polish Notation)	Yes	Yes
Memory Store and Recall 10 Registers	Yes	Yes
4 Level Stack, Rotate Stack	Yes	Yes
10 MEMORY EXCHANGE WITH X	Yes	No
Log. LN	Yes	Yes
Trig (Sine, Cosine, Tangent, INV)	Yes	Yes
HYPERBOLIC (SINH, COSINH, TANH, INV)	Yes	No
HYPERBOLIC RECTANGULAR ↔	Yes	No
y^x, e^x, 10^x, $\sqrt{x}$, $1/x$, x!, x←y, π, CHS	Yes	Yes
$\sqrt[x]{y}$ through INVERSE	Yes	No
GRADIANS	No	Yes
DEGREE-RADIAN CONVERSION	Yes	No
Degree Radian Mode Selection	Yes	Yes
DEC-DEG-MIN-SEC	No	Yes
Polar to Rectangular Conversion	Yes	Yes
Recall Last X	Yes	Yes
Scientific Notation, Fixed and Floating	Yes	Yes
Fixed Decimal Point Option (0-9)	Yes	Yes
DIGIT ACCURACY	12	10
DISPLAY OF DIGITS	12	10
%, △%	Yes	Yes
GROSS PROFIT MARGIN %	Yes	No
Mean and Standard Deviation	Yes	Yes
Σ+, Σ−	Yes	Yes
Product – Memories	Yes	Yes
C.F. DIRECT CONVERSION	Yes	No
F.C. DIRECT CONVERSION	Yes	No
LIT-GAL. DIRECT CONVERSION	Yes	No
KG-LB. DIRECT CONVERSION	Yes	No
GAL-LIT. DIRECT CONVERSION	Yes	No
LB-KG. DIRECT CONVERSION	Yes	No
CM-INCH DIRECT CONVERSION	Yes	No
INCH-CM DIRECT CONVERSION	Yes	No

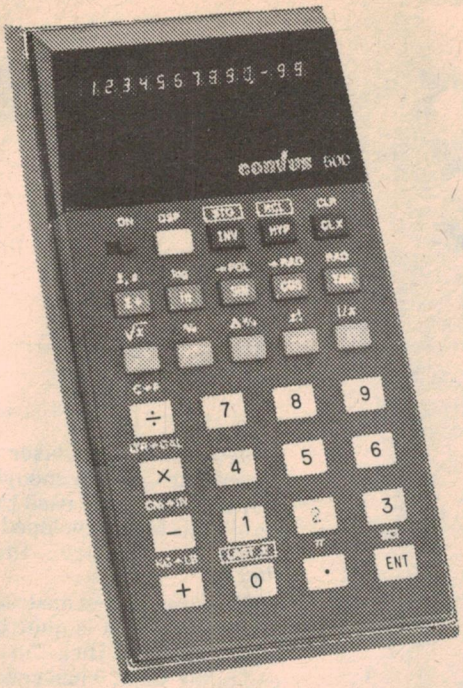
As you can see, the Corvus 500 is a lot more calculator for **$79.95**

Price	**$95.00**
Mail charge	**$2.50**
Sales Tax exempt	**$72.50**

For sales tax exempt purchases, please supply number or certificate.

We have listed some of the many features, but let's amplify on some highlights:

1. RPN (Reverse Polish Notation) "COMPUTER LOGIC" and 4 LEVEL STACK.



Your problem is solved the way it is written, left to right sequence, eliminating restructuring, unnecessary keystrokes, and the handicap of having to write down intermediate solutions. And all information is at your disposal — just roll the stack (R) to any intermediate information desired. You arrive at your solution faster, more simply and, therefore, more accurately.

Perhaps at this point we should address ourselves to the controversy between algebraic entry and RPN. One question we must ask is why proponents of algebraic entry always use an example of sum of products and never an example of product of sums:

$(2+3) \times (4+5) =$

Algebraic 2 + 3 = MS 5 + 4 = X MR = TOTAL 12 keystrokes (SR51, add 2 more keystrokes)

RPN: 2 Enter 3 + 4 Enter 5 + x
TOTAL 9 keystrokes

2. THE CORVUS 500 and HP-45 HAVE 10 ADDRESSABLE MEMORY REGISTERS, 4 LEVEL OPERATIONAL STACK, and a "LAST X" REGISTER (10th Mem. Reg.). With 10 addressable memories, you have access to more entries, or intermediate solutions; less remembering, or writing down, YOU have to do. And less chance for error. The stack design also permits X and Y register exchange, and roll-down to any entry to the display for review or other operation. The "last x" register permits error correction or multiple operations when a function is performed, the last input argument of the calculation is automatically stored in the "last x" register, which can be quickly recalled to correct an error, or to perform another operation using the same number.

3. DIRECT HYPERBOLIC and HYPERBOLIC RECTANGULAR to POLAR, and INVERSE. For those of you electronic and computer science engineers who require access to this specialised application, the Corvus 500 solves "your" problems.

4. A WORD ABOUT CORVUS 500 12-DIGIT DISPLAY AND ACCURACY. Finally you have displayed 12 digit accuracy in business format and 10 + 2 in scientific notation. LED is manufactured by Hewlett Packard.

FOR THE FIRST TIME you can raise the number 10 to 199th power or calculate Factorial (x!) of up to 120. Unbelievable!

5. DIRECT FROM AND TO METRIC CONVERSION SAVES VALUABLE KEYSTROKES.

WHAT ABOUT CONSTRUCTION? With so many features, the next most obvious question must be in regard to the quality of the unit itself. We are proud to report the Corvus 500 to be double injected moulded, with "tactile" feedback keyboard. The compact, contoured case is 5½" long by 3" wide by 1¼" high and weighs just 8 oz.

The COMPLETE CORVUS 500 for **$79.95** includes:

- Rechargeable and replaceable Nickel Cadmium batteries. Optional 3AA batteries.
- Adaptor/Charger.
- Owner's Handbook.
- Soft carrying case.

The Corvus 500 is warranted by the manufacturer against defects in materials and workmanship for one year from date of delivery.

For those of you who have the HP-21 or 45 or any other advanced calculator on order, aren't you glad you still have the opportunity to take advantage for the release of the Corvus 500 for **$79.95** Hurry! Order yours today.

AN INVITATION:

Electronic Concepts is proud to offer this exciting Corvus 500 as well as other Mostek based calculators and digital watches as exclusive importer of Corvus Brand products for Australia.

You, our discerning reader will no doubt recognise the tremendous price/ performance value on offer. By mailing the order coupon today we can assure you of early delivery — and should you not be satisfied, you may return the unit to us with full money back guarantee within seven (7) days.

Or better, convince yourself of the real quality and value of our Corvus range, just visit our conveniently located showroom in Cambridge House, Clarence Street, just behind Wynyard exit (York Street), or phone 02-29-3755 for more information.

Other Corvus models on offer:

Corvus 600 Financial Genius $69.95

Corvus 615 Business Statistician $19.95

Corvus Digital Watches — but more about these in our next advertisement.

ELECTRONIC CONCEPTS PTY LTD

Ground floor, Cambridge House, 52-58 Clarence St., Sydney NSW 2000. (02) 29 3753-4-5

Yes! I'd like to try the Corvus 500 for 7 days

CASH payment: Cheque or money order enclosed. $79.95 plus $2.50 postage.

NAME .....

ADDRESS .....

..... POST CODE .....

bankcard 1st time offered for your convenience BANK CARD mail order facility. Please complete

☐ Please charge my bankcard.

BANKCARD NO .....

EXPIRY DATE .....

SIGNATURE .....

CB AUSTRALIA

The CB article in our January issue seems to have made quite an impact, judging by the feedback we have received from retailers, readers and the media. Interest in CB has grown considerably since Roger Harrison wrote the article so when it came to publishing the promised survey of CB transceivers in this issue we thought of what other ways we could satisfy the demand. And less than a week before Press Day we thought of putting a special section — CB Australia — inside this issue.

Most of the writing was done by Roger Harrison, VK2ZTB, with Steve Braidwood, VK2BSY (ex G3WKE), editing and putting the magazine into shape.

Because of the volatility of the CB issue we can't say with any certainty when Vol 1 No 2 will be published — but ETI will keep you in touch (and the next issue of ETI will be out about a month after this issue).

12% Growth for Electronics

The electronic markets of the US have been the first of the three major producers (U.S., Western Europe and Japan) to rebound from the slum of 1975. Sales of electronic equipment grew by 12.4% to $50,580 million in 1976 and should reach $56,350 million this year (an 11.4% increase).

A survey of Western European countries indicated a gain of little over 11% in 1977 to $23,680 million for electronic equipment. The situation is not totally uniform, consumption in the UK, Italy, Scandinavia and Benelux countries are lurching along, while the market in West Germany continues to stabilise Europe's growth.

It's predicted that the Japanese electronic producers have exported their way out of recession. A survey conducted in Japan shows a 17% rise in the dollar value of equipment purchased domestically, reaching $13,660 million.

The estimated grand total of these three markets comes to $93,690 million for 1977, however these figures have not been corrected for inflation rates.

Electronic Injection — into the bloodstream

The Siemens micro-dosage system can continually inject insulin into the bloodstream of a diabetic at an extremely slow rate. In the order of microlitres per hour can be injected via a catheter. This means that rather than having daily injections diabetics now need only to refill their insulin storage device at intervals of several months.

NEW TAXI ALARM SYSTEM

Taxis Combined Services Pty Ltd of Sydney have just signed a $430,000 contract for a totally new taxi alarm system designed by Philips TMC Radio Division in Melbourne.

The Status and Identification system sends out special status signals to help combat and deter attacks on taxi drivers.

The system is designed to reduce the 'on air' time of traffic by introducing data communication as well as voice.

When the base operator sends out a call, those drivers wishing to 'bid' for the job simply press a button. The first driver to register his 'bid' gets the job. Once the driver has the details he just presses a 'roger' button to let his base know he is on his way. If he did not understand some part of the information, he presses another button marked 'repeat'. On the other hand, if the driver wishes to speak to the operator, perhaps to tell him that the street number he was given does not exist, he presses another button marked 'query' and the base operator then allows him to use his normal microphone for a brief period.

The system also has a built-in alarm system that could help to reduce the number of attacks on taxi drivers and lead to the capture and conviction of more attackers.

At the base station, the operator knows immediately which driver is in trouble because his taxi number is flashed up on a display. The operator then presses a button to tell all other taxis on the frequency to keep off the air because of the emergency.

From this point there is a procedure to enable the operator to locate the driver and indicate the sort of trouble he is in.

ETI CIRCUITS BOOK

This book contains stacks of circuits taken from the Ideas For Experimenters section of the international editions of ETI. Many have never been published before in Australia and the whole collection is specially categorised to enable the designer to find the kind of circuits he is looking for without having to wade through a library of books and magazines.

ETI Circuits No 1 is available from The Subscriptions Department, Modern Magazines, 15 Boundary Street, Rushcutters Bay, NSW 2011, for $2.50 per copy or from all major newsagents from February onwards.

Result of December Contest

This is the result of the contest devised by G. Perry and set in our December issue: the children's ages are two, two, and nine.

The result is arrived at by looking at the factors of 36:

1,1,36.....(sum 38)
1,2,18.....(sum 21)
1,3,12.....(sum 16)
1,4,9.....(sum 14)
1,6,6.....(sum 13)
2,2,9.....(sum 11)

When the salesman looks at the number of the house next door he will be able to work out the ages. Unless, that is, the number is 13. Then he will need to know that the eldest plays the piano (to eliminate the possibility of the ages being 6,6, and 1).

The first randomly-picked correct entry was sent in by T. Cuttle of Chermside, Queensland, and he will receive the prize of a Unitrex calculator.

TV Damage

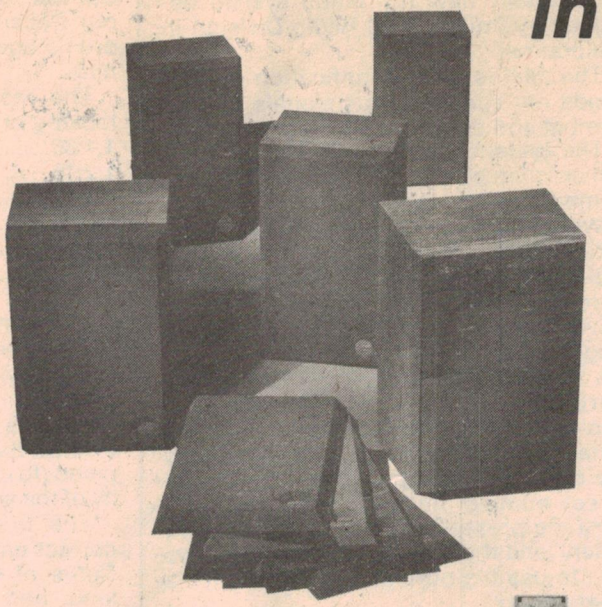
TV Games can damage the CRT of your television set — but not, according to games manufacturers, if you use the game normally and properly. Ion beam burn has been spotted on a few sets — but only those which display the game for very long periods (demonstration sets in stores and coin-operated sets in pubs). In the home the only danger arises when the brilliance control is turned up much too high and the game is displayed for abnormally long periods.

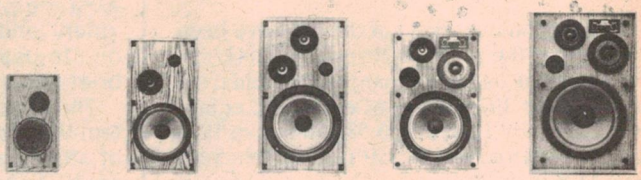
Dick's DIY Leaflet

Dick Smith's publicity department recently sent us a four-page leaflet "How to install your own burglar alarm" by Dick Smith. This is said to be part of a Dick Smith "Do It Yourself" Series, but we don't yet have details of any other publications. Three pages cover the theory and practice of installation (including a drawing reprinted from ETI) and one page is an ad showing you a range of products from the Dick Smith catalogue which you might use when you wire-up an alarm system. The leaflet sells for 25c.

New from Altec...

elegant in design ... outstanding in performance





From the leader in Studio Monitors . . . the new standard for the discriminating listener. All cabinets are natural North American hardwood veneers, hand-rubbed and oiled. Two-way and three-way systems. Choice of grille colours on selected models.

	MODEL ONE	MODEL THREE	MODEL FIVE	MODEL SEVEN	MODEL NINE
SPEAKER COMPONENTS					
LOW FREQUENCY:	8'' bass driver	10'' bass driver	12'' bass driver	12'' bass driver	12'' bass driver
MID FREQUENCY:				6½'' frame cone driver	6½'' frame cone driver
HIGH FREQUENCY:	4'' frame cone driver	4'' frame cone driver	2 each 4'' frame cone drivers	4'' frame cone driver	5'' frame cone driver
NOMINAL IMPEDANCE:	8 ohms	8 ohms	8 ohms	8 ohms	8 ohms
CROSSOVER FREQUENCY:	3000 Hz	1500 Hz	1500 Hz	850 Hz, 8 kHz	800 Hz, 7 kHz
ENCLOSURE TYPE:	Sealed	Vented	Vented	Vented	Vented
FREQUENCY RESPONSE:	50 Hz to 20 kHz	50 Hz to 20 kHz	45 Hz to 20 kHz	45 Hz to 20 kHz	40 Hz to 20 kHz
OPERATIONAL POWER RANGE: Recommended for use with amplifiers between these levels	12 watts to 75 watts, 30 watts continuous	10 watts to 100 watts 35 watts continuous	12 watts to 150 watts 45 watts continuous	15 watts to 200 watts 50 watts continuous	12 watts to 250 watts 60 watts continuous
FINISH:	Hand-rubbed oiled oak	Hand-rubbed oiled oak	Hand-rubbed oiled walnut	Hand-rubbed oiled walnut	Hand-rubbed oiled oak
GRILLE:	Acoustically transparent brown knit fabric mounted on removable frame	Acoustically transparent black knit fabric mounted on removable frame	Acoustically transparent black knit fabric mounted on removable frame	Acoustically transparent foam mounted on removable panel. Choice of black, brown, blue, or burnt orange	Acoustically transparent foam mounted on removable panel. Choice of black, brown, blue, or burnt orange
DIMENSIONS:	53.3cm H x 29.2cm W x 26.4cm D	60.9cm H x 31.8cm W x 29.2cm D	64.8cm H x 36.8cm W x 30.5cm D	63.5cm H x 40.6cm W x 35.9cm D	67.3cm H x 44.5cm W x 38.1cm D
WEIGHT:	10.4 kg	12 kg	14.5 kg	20 kg	25.4 kg

KENT HI-FI

(WHERE THE BEST EQUIPMENT COSTS LESS)

410 KENT STREET
SYDNEY
ph: 29-2743

WIN A UNITREX CALCULATOR!

This month's puzzle was sent in by B.J. Boyce of Epping, NSW.

Each of the letters used in the alphametic below stands uniquely for one of the digits 0 to 9.

```
  ETI
 READ
   BY  +
-------
 MANY
```

To make it a little easier for you Mr Joyce advises that all four numbers are divisible by three. To enter the contest send us an empty envelope with our address on the front and yours on the back. Also on the back list the numbers 0 to 9 and the corresponding letters. This contest closes on 15th March 1977.

AMATEUR RADIO CONVENTION AT GOSFORD

The central coast amateur radio club will be holding their 20th annual 'field day' on Sunday 20th February. This enormously popular event is usually attended by more than 600 amateurs and SWL's every year. Venue is the Gosford Showgrounds, Showground Road, Gosford. Registration commences at 8.30 am and costs $4 for the OM, $2 for the YF or YL and $1 for kids under 16. The fee covers entry, morning tea, lunch, afternoon tea and outings.

The club station VK2AFY will be operational on Gosford repeater Ch.3., Ch.40 simplex and 7050kHz SSB. A whole range of events are organised for the day; mobile fox hunts, pedestrian fox hunts, mobile scrambles etc as well as a bus tour of the surrounding area including a visit to Eric Worrell's Reptile Park. Apart from all that there will be trade displays with equipment and components, kits etc on sale.

There will be a 'disposals' sale of unwanted gear and good junk (very popular), along with a ladies' stall, electronic musical equipment display, amateur TV display etc. There will be a soft drinks stall and ragchew lubricant available. There is plenty of parking in the showground and adequate shelter should the weather be inclement. Amateurs come from near and far, there is much renewing of old aquaintances, making of new ones and discussions on the latest gear, when the DX is going to return etc. Roll up for the eyeball of the century (or fox hunt, or scramble or spending spree).

NEW ELECTRONICS CENTRE in W.A. ALTRONICS is a dealership of Dick Smith Electronics. The shop is located at 105 Stirling Street, Perth.

HAM COURSE

YMCA Radio Club is promoting a course of study for the full AOCP consisting of three classes A,B&C, all based on Amateur Radio handbooks either ARRL or ORR. Also incorporated are five practice tapes "introduction to morse code".

The classes will be held this year (77) at the Adult Education Centre, corner Alice and William Streets, Brisbane. Lectures are to be conducted by Mr R A Everingham VK4EV and Mr T Thompson VK4ETT.

For information contact:

ACT & NSW – DIACOM, PO Box 37, Fisher ACT 2611 (tel: 82-3581).

QLD – WIA, Box 638, GPO, Brisbane 4001 (48-6142).

All others, Roger Davis 2/32 Farrington St, Alderley, 4051 (SAE).

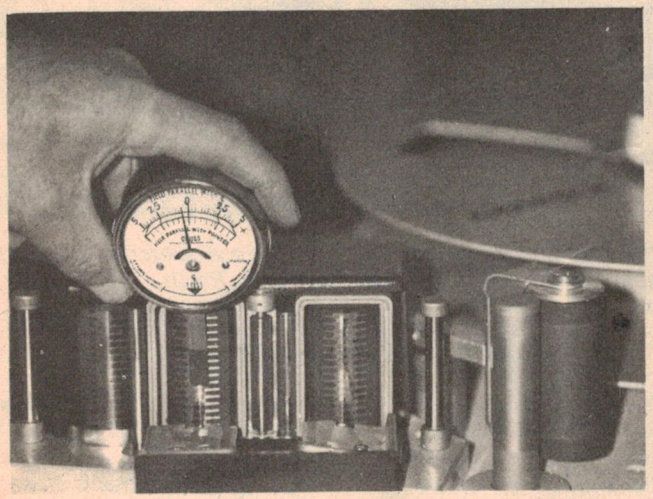
ANNIS

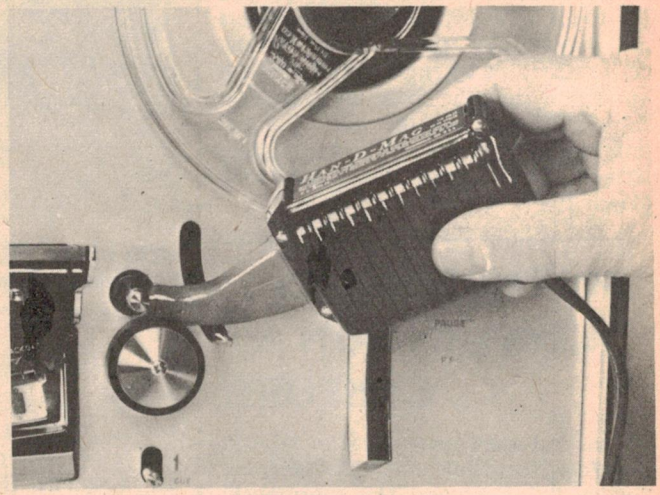
Protect valuable recorded tapes with an...

Audiophile HAN-D-KIT

Provides everything needed to measure and eliminate magnetism in recorder components before recorded tapes are damaged permanently

HOW TO PRESERVE THE FIDELITY OF YOUR FAVORITE TAPES INDEFINITELY





1 Check Magnetism in Recorder Components

The Annis Pocket Magnetometer quickly and accurately measures residual magnetism levels in recorder heads, drive capstans or tape guides. Indicates when it's time to demagnetize and lets you know when it's again safe to use the recorder.

2 Demagnetize Components When Necessary

Whenever the Magnetometer indicates any appreciable level of magnetism in a tape transport component, you can demagnetize it effectively with the powerful Annis Han-D-Mag before it causes permanent damage to recorded tapes.

Valuable audio and video tapes can be damaged when played on equipment that is not thoroughly and regularly demagnetized. Magnetism can easily build up in capstans, tape guides or recorder heads to a point where it will degrade the magnetically recorded signal on tapes passing over them. Tape damage is first apparent as a loss of recorded high frequencies and a progressive increase in background noise each time they are played on magnetized equipment.

Until recently, there has been no easy way to tell when demagnetizing was needed, and most Demagnetizers on the market were far too weak to be effective, particularly on offending hardened steel guides or capstans, etc. Now, with the introduction of the Audiophile Han-D-Kit, both measurement and correction problems can be solved easily at modest cost.

Here in one convenient package is everything needed to measure magnetic levels quickly, along with a handy, powerful unit to demagnetize components completely before they can spoil valuable tapes.

HERE'S WHAT THE AUDIOPHILE HAN-D-KIT CONTAINS

ANNIS POCKET MAGNETOMETER
Measures level of magnetism in components. Calibrated to read directly in gauss. Model 20/B5 shown.

TEST STRIPS
One of these sensor strips is magnetically soft and the other magnetically hard. For experiments and testing your demagnetizing technique.

CLIP-ON EXTENSION PROBE
Extension probe is 1¾" long. Can be formed with fingers. Improves checking of magnetism in hard to reach components.

"NOTES ON DEMAGNETIZING" ETC.
Explains causes of magnetism, with particular reference to tape recorders. How to measure it accurately and how to eliminate it. Interesting experiments also included.

ANNIS AUDIOPHILE HAN-D-MAG
A rugged, dual-use Demagnetizer having a powerful, sine wave demagnetizing field strength of over 350 oersteds ¼" beyond the tip of the 2¼" long probe.

OPTRO Pty Ltd

17 Arawatta St., Carnegie, Vic. 3136. Ph: (03) 569-0978

OPTRO PTY LTD

AURIEMA CONTEST RESULTS

The Auriema 'Super System' contest in ETI's October issue attracted a vast number of entries — most of which as usual were of a very high standard.

Winner of the major prize is Mr. Wallace G. Hastie of Glen Waverley, Victoria. Congratulations Mr. Hastie — we know you put in a great deal of effort. And we're sure you will enjoy using the superb Marantz hi-fi system that you have won!

Runners up were Mr. J. Noble of Greenwich NSW and Mr. P. O'Neill of Kew Victoria.

Correct answers were as below.

Q. What is a 'boffle.?
A. A loudspeaker enclosure designed by Hartley.
Q. Explain why a dbx unit is desirable.
A. When music is recorded, the dynamic range is compressed to fit the capabilities of the recording equipment. The dbx can re-expand that range on playback — giving a more realistic performance and improved S.N. ratio.
Q. The running speed of Marantz' 6200 turntable can be adjusted by a control knob. Give at least **two** reasons why this is a desirable feature.

The speed control knob allow us to adjust the pitch of the music to suit us when it has been recorded at a slightly different speed or when the performers (particularly in some other countries) play at a pitch other than our standard (a' = 440 Hz). The latter is particularly significant for listeners with "absolute pitch" and for musicians who need to play along with the recording (eg. the "Music Minus One" records).
The control also enables us to compensate for local differences in mains power supplies (with a given nominal voltage).

Q. In 1963 a Chinese soprano lost her ability to sing top notes. Her predicament was likened to a sailor serving 20 years in Long Bay gaol. Sum this up — using no more (or less) than four words.
A. Long time no C.
Q. Who wrote the following:
"Lord Finchley tried to mend the electric light
It struck him dead, and serve him right
It is the business of the wealthy man
To give employment to the artisan."
A. Belloc.
Q. Experts generally agree that if an amplifier's distortion is below a certain level the distortion cannot be heard. What is that level?
Q. 0.10%
Q. 1200 cents equals $12. But what else is it equal to? Keep your temper answering this!
A. Cent, in music, is the interval between two pure tones whose frequency ratio is the 1200th root of 2 or the 100th root of the tempered semitone interval.
1 cent = 1/1200th of an octave.
∴ 1200 cents = 1 octave.
Q. Under average conditions what is the minimum change in sound level that the average listener can detect?
A. 1.5 dB

Our thanks to Auriema Pty Ltd for their co-operation in this contest.

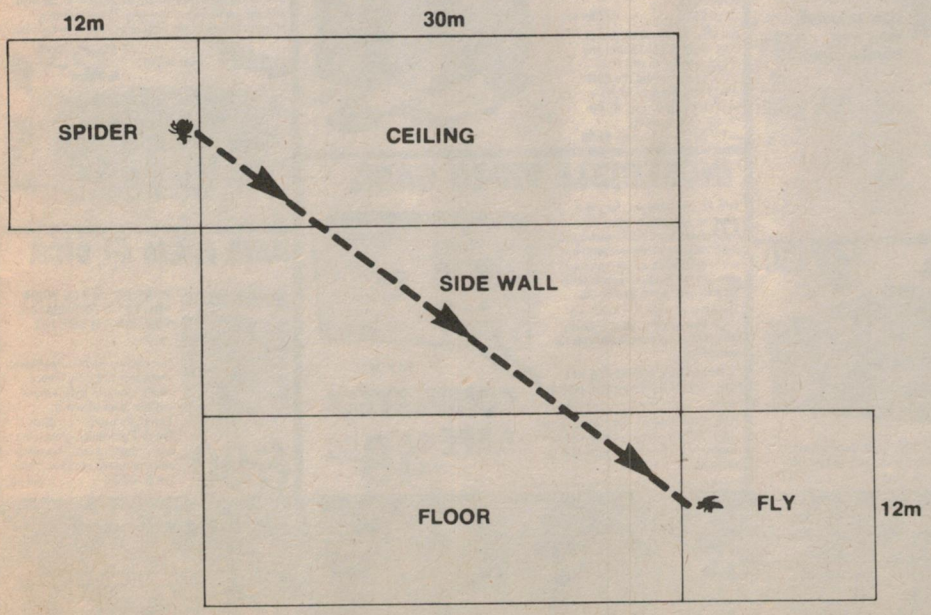
The Spider and the Fly

In our December issue we posed the problem of the spider and the fly —

A spider is on the vertical midline of one wall of a room, one metre down from the ceiling. A fly is on the opposite wall, on the midline but one metre up from the floor. The fly is paralysed and the walls are 12 m square and 30 m apart, what is the shortest distance the spider has to crawl to reach the fly?

The answer is 40 m and below we show the path the spider must follow to achieve this:

The 40 m is the hypoteneuse of a triangle with perpendicular sides of 32 m and 24 m.



Up-dating old records

Ever wanted a new stylus for your Edison cylinders? Or for your Edison diamond disc, Pathe hill-and-dale disc, or your old 78s? These stylii are now available in Australia (a bit late, perhaps) from Stanton Magnetics through Leroya Industries Pty Ltd, 156 Railway Parade, Leederville, WA.

ERRATA

Since publishing our ASCII encoder project in December 1976 we have changed the values of R30 and R31 to 47k and 10k respectively. This was because Q17 was not saturating sufficiently.

$350 VALUE FOR $279!!

INCREDIBLE... BUT TRUE!

You've probably heard someone who picked up a so-and-so rig in the States for so much – usually well under Australian selling prices.
Try that with one of these brand new Midland 13-893's: . you'll be in for a rude shock! Current advertised prices for the 13-893 is around $350 each in the USA!
Dick Smith's price in Australia : ONLY $279.50!!!!!

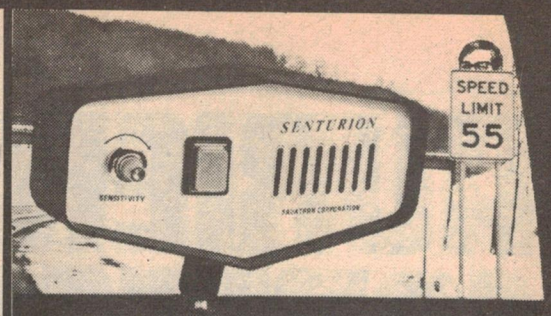
The 13-893 is considered to be a 'Rolls-Royce' model in the CB field. A true **DOUBLE CONVERSION** superhet receiver; and the transmitter has not only RF & audio gain controls, but a **MICROPHONE GAIN CONTROL** as well! That's a v-e-r-y handy control – lets you control your modulation so every man & his dog can't eavesdrop your QSOs.

- DOUBLE CONVERSION SUPERHET RECEIVER
- 3 MODES – AM, USB & LSB – ON 23 CHANNELS
- MICROPHONE GAIN CONTROL
- 0.5uV SENSITIVITY

Cat D-1701 **$279.50**

While stocks last, the fantastic 13-893 is exactly the same price as the famous 13-892 (it should be much dearer if overseas ads are any guide!) At the time of going to press, stocks of the 893 were good – but we cannot guarantee how long this will last! If you want one, better grab one now – before they disappear!

********** WHILE STOCKS LAST **********



THE MOST SOPHISTICATED, SENSITIVE MICROWAVE DETECTOR AVAILABLE...

INSTALLING ONE OF THESE RADAR DETECTORS IN YOUR CAR WILL ACTUALLY MAKE YOU A SAFER DRIVER.

Everyone does it: you don't pay as much attention as you should; suddenly you find you are well over the speed limit. If you're lucky, you drop down to the limit (until you do it next time!) If you're not so lucky . . . .

A radar alarm in your car makes you a safer driver by keeping you aware of the speed limit. You find that just knowing the thing is there increases your attentiveness; you don't let your mind (and speed) wander so you become less prone to mental abberations.

WHY PAY $130 OR MORE FOR A LESS EFFECTIVE UNIT?

DICK'S PRICE:

$115

Cat A-8502

FEATURES: 2 alarms (1 audio & 1 visual) – external power from car cigarette lighter (not internally powered as earlier models were) with lighter plug and lead supplied – easy stick-on attachment to dash (supplied) – sensitivity control – neat, unobtrusive appearance on car dashboard – low power consumption

DUMMY LOAD $3.50

WATCH YOURSELF TALK!

This incredible little dummy load contains a light globe which lights up on transmit. The lamp changes brightness with modulation level. You can actually watch yourself talk!

Suitable for all CB transceivers, will handle peak powers of 5W. Mounted in a standard PL259 plug, which just screws into the antenna socket of your transceiver. Easily replaceable bulb. **Cat D-7024** **$3.50**

WHITE FLASH

This BRAND NEW 27MHz helical antenna – EXCLUSIVE TO DICK SMITH – comes ABSOLUTELY COMPLETE with mounting base, lead-in & PL259 plug.

We predict this will be the most popular antenna ever!

brand new

KNIGHT OF THE ROAD $29.00

Cat D-4076

Dick Smith always carries a full range of CB Radio – apart from CB radios themselves (of which he's got probably the biggest range in the Southern Hemisphere!) He's got antennas large and small, for boat or base; for mobile – even for pedestrians! And test gear: SWR meters, impedance meters, multimeters, etc. Matchboxes, TVI filters, dummy loads, cables, base supplies, battery chargers, batteries, etc etc etc etc. Check the range out yourself – you'll see why most CBers go to Tricky Dicky for their goodies!

SANYOYOYO!

This fantastic hand-held rig is now back in stock. Incredibly versatile high power transceiver, can accept crystals for any 6 of the 23 CB channels or the marine & boating channels. Full 5W input power, can be used as a normal hand-held or as a base with its external power, external mic, external antenna, external speaker and external charger jacks!

NEW PRICE WILL BE OVER $100.00 BECAUSE OF DEVALUATION!

SPECIAL: ONLY $79.50 INCLUDING 27.88MHz XTALS!

IN STOCK NOW

$79.50

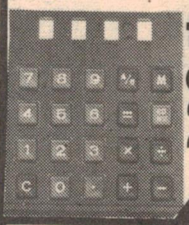
Cat D-1142

FOR MICROPROCESSORS & VDTS

INCREDIBLE LITTLE CALCULATOR KEYBOARD

Ideal for conversing with a computer, mixing with a microprocessor. All have 4 functions & 10 digits, but some have different notations on other keys (5 x 4 matrix). Some are pre-used but as-new condition.

Cat X-1170



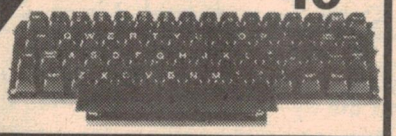
few only 2.00

WATCH FOR DETAILS OF THE COMPUTER TERMINAL KITS

JUST THE THING FOR ALL THE VIDEO TERMINALS IN THE MAGS!

Full alpha-numeric keyboard, with control keys, space & tab, everything you would find on a computer keyboard (funny, because that's what they are!) Individual key contacts (spst) for virtually any wiring up mode, or for any encoding system.

Cat X-1180 **$49.50**



TICK TOCKS

INCREDIBLE MA1002 CLOCK MODULE

The clock-on-a-chip from NS. All on a single PCB – Dick's price just $13.50.

Or the complete kit – including the module, power transformer & switches PLUS FULL DATA SHEETS. You'll see it advertised for around $21.00 +. **Dick's price: $19.75** . Why buy elsewhere when you can save real money and get real service from Dick!

MA1002 Module Cat X-1052 .. .. **$13.50**

MA1002 kit: IC & display module, transformer switches & full data. Cat K-3434 .. .. **$19.75**

OR HOW ABOUT THIS ONE: A FANTASTIC 12V FULLY SELF–CONTAINED CLOCK ON A PCB.

In some ways, similar to the above – it too has the IC, readout & electronics on the one PCB – but there the similarity ends! This one has an incredibly accurate crystal-derived timebase – operating from a single 2.097152MHz rock. Try and match that sort of accuracy with a mains-locked clock! And this one operates from 12V DC – use it anywhere and everywhere – in the car, boat, plane, etc – its bright green gas discharge display is easy to see even under high ambient light! Measures a tiny 75mm x 45mm – almost the size of the picture below. With data sheets.

VALUE Cat X-1049 **$32.50**

STUDENTS!

UNI & TECH COURSES ARE ON AGAIN! And you're a year older! Is last year's calculator good enough for your more advanced studies this year? Go on – give your marks a boost. Get an up-to-date **programmable** calculator. You won't be sorry!

TEXAS SR-52

224 step program memory
20 memory registers
10 user defined keys
10 con. branches
3 uncon. ,,
5 flags
2 subrout.
72 labels
etc etc
etc!

Cat D-3724

22 pre-recorded program cards supp.

$299.98

ALARM THE BURGLAR

Protect your property with a **professional** alarm system. Install it yourself and save lots of money!

Contains all sensors, inc window, fire, etc, plus the master control centre.

Bewdy, mate!

Cat L-5105 **$37.50**

YOU can do it with the Dick Smith 'How to Install Your Own Burglar Alarm' leaflet. Incredible value at 25c, or

FREE when you buy the above alarm. Cat B-4500

DONT FORGET TO ASK FOR IT!

FANTASTIC SPEAKER KIT

ANYONE can build a pair of these superb little speakers in just a couple of hours . . .

All instructions are supplied – if you can read, you can build these speaker boxes! All you need is a tube of glue & a screwdriver!

Cat C-2610 .. .. **$27.50 ea.**

Speakers to suit above boxes: You could use just about any 8 inch speaker in this box – but we recommend the C8MX which sells for just $7.50 – that's a saving of over $5.00 on our catalog price!

Cat C-2012 .. .. .. **now $7.50**

INCREDIBLE VIDEO GAME

This kit gives you far, far more than the usual video game kits: 6 selectable games with automatic digital scoring on screen; with just about everything on screen selectable to your requirements & skill: bat size, ball speed, angles, etc.

The kit is very easy to build – a single box contains all the 'works' with separate armchair controls for each player.

COMPLETELY COMPLETE KIT INCLUDES FRONT PANEL DECAL

Cat K-3432

This is the original 'Electronics Today' (Nov 76) kit; not a backyard design where you don't know what you're getting . . .

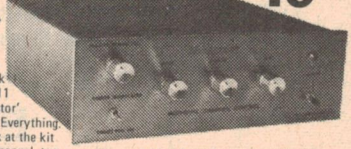
COMPLETELY SAFE $49.50

BRAND NEW MUSICOLOR $49.50

WITH DICK SMITHS *** EXCLUSIVE *** CHAMPAGNE FRONT PANEL.

You can build this kit successfully – even if you've never seen a resistor in your life! With our new-look Musicolor 111, you get our brand new Musicolor 111 instruction manual – everything from 'this is a resistor' to 'Sit back and relax, and watch the pretty lights'. Everything. So you really can't go wrong, can you? Have a look at the kit today at your Dick Smith store or dealer. And the manual, too. Then you will see this is just the kit for you!

Cat K-3140 .. .. **$49.50**



Also available: Special 'short form' kit which contains PCB, components, etc, but no case or 'hardware'. **Cat K-3141** **$29.50**

DATA FROM DICK

WHAT DO YOU DO WHEN YOU GET A TRANSISTOR YOU CAN'T IDENTIFY?

CRY?

Not any more! With the World Transistor Cross-Reference Guide, you can always work out the specs. Quickly. Especially printed for Dick Smith Electronics, gives specs and equivalents for thousands and thousands of types. Value!

6.00

Cat B-4506 .. .. **$6.00**

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DEALER PRICES MAY BE HIGHER TO COVER HIGH TRANSPORT CHARGES

SHOP HOURS
Mon – Fri: 9 to 5.30
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POSTAL CHARGES

ORDER VALUE			CHARGE
$5	to	$9.99	$1.00
$10	to	$24.99	$1.50
$25	to	$49.99	$2.50
$50	to	$99.99	$3.50
$100 or more			$5.00

BY COMET FREIGHT : THE MINIMUM PACKING AND HANDLING CHARGE IS $1.00. WE DESPATCH "FREIGHT-ON" AND YOU PAY WHEN YOU RECEIVE THE GOODS.
FOR C.O.D. SEND $2.40 EXTRA PLUS $3.00 DEPOSIT.
MINIMUM MAIL ORDER AMOUNT IS $5.

NOW YOU CAN BUILD THE FABULOUS PLAYMASTER "FORTY FORTY" and the PLAYMASTER "TWIN 25"

Designed by Leo Simpson of Electronics Australia.

FORTY FORTY **$105** TWIN 25 **$89.50**

Packing & Postage for Playmaster Forty Forty is $5.00 & for the Twin 25 is $3.50

ATTENTION

This Playmaster Forty Forty has the low noise transformer. The Twin 40 is a cheaper amplifier with a normal iron core transformer. We do not supply the Twin 40 and do not intend to.

FEATURES

***Exclusive Bronzed Anodized Front Panel**
***Professional Knobs to match the Front Panel**
***Level graduation on Treble and Bass controls**
***Simplified complete Instruction Manual and Assembly Instructions**
***Special silk screened fibreglass PC Board**

THE "FORTY FORTY" HAS AN EXCLUSIVE 'C' CORE LOW NOISE (LH) TRANSFORMER

The "C" core transformer in the Dick Smith kit is EXCLUSIVE — and its one of the key components in this amplifier. Normal interleaved (laminated) transformers are alright – just – but for the optimum performance the "C" core, with its grain-oriented steel and better electrical characteristics is hard to beat. The result : a quieter more powerful amplifier. More power can be delivered by transformer with less "noise" being radiated to get in the sensitive front end of the amplifier.
ATTENTION: This amplifier is slightly more expensive because of the "C" core (LH) low noise transformer — however it is really worth the extra $5 — on headphones alone the background noise level is lower.
Cat. K-3411 .. .. Playmaster Forty Forty Kit $105.00

SPECIFICATIONS for BOTH AMPLIFIERS

Power Output:
Forty Forty — 40 W per channel into 8 ohms with 1 channel driven.
Twin 25 — 25 W per channel into 8 ohms with 1 channel driven.
Frequency Response: ± 1dB from 25 Hz to 20 kHz with tone controls level.
Compensation: RIAA to within ± 1dB.
Sensitivity: Phono 2mV into 56k for 25W or 40W output. Other inputs 150mV into 36k minimum.
Overload: On phono 120mV.
Sig/Noise: 70dB (on phono) @ 10mV. 70dB (other inputs).
Crosstalk: Better than -45dB over 100 - 10 kHz.
Distortion: Less than 0.05% at normal listening levels.
Bass / Treble Controls: ± 13dB nom. at 50 Hz and 10 kHz.
Stability: Unconditional.

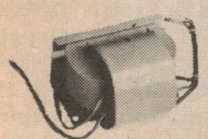
PLAYMASTER "TWIN 25"

For those who require a lower powered unit or who do not have the living area suitable for the higher powered Forty Forty, then the Twin 25 is the ideal amplifier. The 25 watts RMS per channel suits most available speaker systems. "It is about half the price of an imported amplifier with the same power output" says Leo Simpson in Electronics Australia for April 1976. Thousands of these units have already been built during the last few months.
Cat. K-3410 .. .. Playmaster Twin 25 Kit $89.50

CONVERT YOUR EXISTING TWIN 25 TO GIVE YOU 40 WATTS RMS PER CHANNEL.

With this conversion kit you can boost your Twin 25 to give 40 watts RMS per channel. Complete with full instructions and all necessary parts including "C" core transformer. **Cat. K-3435 Conversion Kit Only $25.00**

FREE Power supply circuit included when you purchase the above kit to show you how to use your existing Twin 25 Transformer for a 13.8 volt 2-4 Amp Regulated Power Supply. A must for the hobbyist.



"C" CORE TRANSFORMER ONLY
Cat. M-0148 .. $24.50

OPTIONAL CABINET

Dress up your amplifier with an attractive high quality simulated Teak timber cover. Will give it that $500 look. Suits both the Playmaster Forty Forty and the Twin 25 amplifiers.
Cat. H-3113 .. .. $7.50

SPEAKER PROTECTOR KIT

Suits both the Playmaster Forty Forty and the Twin 25. Get that extra protection for your speakers from damage by amplifier malfunction and switch on / switch off thump.
Cat. K-3425 .. .. $10.75

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Hunts Electronics, Toowoomba (32 6944)
A.E. Cooling, Elizabeth South (255 2249)
The Record Centre, Griffith (621 577)
Altronics Parts, Perth (28 1599)
Bladen Brook Electronics, Tamworth (66 1363)
Dealer prices may be higher due to transport costs.

How to tune-up your Colour TV

By Terry L. O'Connor.

Many people are watching badly set-up colour TV — this article gives some advice on how to spot simple faults and how to put them right.

A TREMENDOUS AMOUNT OF INformation can be picked up by looking at the TV screen. This article looks at those faults on colour sets that can be diagnosed this way and which can be rectified without the need for instruments.

A future article will discuss other faults that can be diagnosed by looking at the screen, but these will be more tricky to correct.

Tuning-Up

Many people have not been shown how to tune a colour set and many so-called colour TV problems are caused by simple control mal-adjustments.

To begin, just turn down the colour to minimum and tune for the best possible black & white picture. Then turn up the colour control until there is colour in the picture. Now, check people's faces on the screen. If they look coloured, then the picture is correct, if not adjust the colour control (or tint control — if the set has one) until lifelike flesh tints are obtained. *Always set the colour (or tint) control on human faces* — never on any other coloured object in the picture.

Finally, recheck the 'fine tuning'

The Operating Controls

Brightness: adjusts from blackout to a "too-bright" screen. The picture should bloom very slightly and may go out of focus at "full-up". Check closely to see that the picture stays black and white at all usable brightness levels, with no tinting what-so-ever.

Contrast: normal setting, in all but the latest models, is full OFF. Full-on contrast can produce a very harsh picture and very bad *apparent* misconvergence. This is normal, too.

Colour: switch off for black and white pictures. As this control is turned up, the colours should gradually get more vivid (go from pale pastel to bright and glaring). There should be no change in the colours (hues) themselves, only in their intensity. This is a "colour volume control"!

Tint or Hue (where fitted): this control changes the colours. The range of adjustment should be such that human faces vary in colour from a sickly green at one end of the adjustment, to a purplish-red at the other. Somewhere in between (about the middle) faces will be "natural looking".

Fine tuning: this control is very important for correct colour. Rotate the fine tuning control through its full range — on a colour picture. At one side there will be sound bars (worms) in the picture. At the other side colour will be lost and there will be a slightly smeared B and W picture.

Correct setting: tune into the "worms", then back up until all of the worms are out of the coloured objects and there is a nice smooth colour. If the fine tuning is left too near one side or the other there can be colour dropouts, or worms in the picture. Set the fine tuning knob as close to the centre of the colour range as possible.

New Installations

A new receiver should do the following if properly installed and adjusted:

First, it should reproduce a good black and white picture. There should be no spots or blobs of colour on the screen, no colour fringes around objects at normal viewing distance. (You can put your nose right up to the screen, and see a little fringing in most sets, around the edges — 100% convergence is almost impossible, although some of the latest sets almost achieve this.)

However, if the picture looks "clean" at normal viewing distances, that's ok.

Remember, all adjustments on a colour set are made to obtain a good black and white picture. If these are correct, then the colour will take of itself.

Valves

There are some hybrid and all-valve receivers around, although the majority of sets are now solid-state.

Valves can be replaced one at a time. Make sure the power cord is disconnected and the valves are stone cold. Some electronics stores have "free" valve testers, but whilst these are fine for spotting major faults some testers are not really sensitive or accurate enough to evaluate minor faults that nevertheless cause major problems.

If such a tester *is* used be careful not to mix up the valves. Mark them quite carefully so that you replace them in the correct sockets.

The value of valve testers depends a great deal on the skilled *evaluation* of the results. Single valve replacement — watching to see if there is any improvement in the receivers performance — is still the best method if you can manage it.

Convergence

It cannot be over-emphasised that convergence adjustments must be left strictly alone, unless a good stable dot crosshatch generator is available. Never attempt to reconverge or to "touch-up" these adjustments on programme transmissions! There must be a stable pattern of some kind, and TV programme material is always moving. Another caution: when working at the rear of the set, never let an elbow hit the convergence yoke or blue lateral magnet. If they are knocked, reconvergence will then be a *must.*

Faults That Are Not

Now, before going on, let us look at a couple of faults that are not really faults

at all. Every one of these can cause unnecessary service calls.

Temporary dropout or shift of colour in the middle of a programme: most common causes are network, Telcom coaxial repeater or switching, or station trouble. If this occurs often, say at least three times during a half-hour colour show, there may be an intermittent IC, transistor or other component in one of the colour circuits.

Difference in colour between TV stations: not at all uncommon! This is due to differences in transmitters, operators, network, amplifiers, Telcom repeater stations and so on. One station may have "very strong colour" while another can be very pale, even though both may even be transmitting the same show. The fault is not in the receiver!

As long as good colour can be obtained by adjusting the colour control, or even the tint control, then the set is working correctly.

Abrupt Colour Troubles

"It was working fine when I turned it off!" We now deal with such problems as no colour at all, apparent misconvergence, worms in the picture, etc.

First, check all the operating controls.

Children, and "unqualified engineers", like a friend or brother-in-law, may have turned some of the knobs. Never panic! Someone could have turned the brightness control all the way down to off.

If there is a chronic fiddler in the family, it may be necessary to check the rear controls. I had a customer recently who had used a pocket screwdriver on all the rear controls where he could find a screwdriver slot.

Determine for sure what has happened. If there is a real "sudden trouble", it is almost certain, statistically, to be a single bad IC or transistor. DO NOT make any adjustments to the rear controls at random. There are methods of determining what has occurred.

What Not To Do

There are certain things on a colour TV that must *never* be adjusted without cause, and even then only when a full set of test instruments are on hand. Actually they seldom cause trouble, because of the way the sets are manufactured.

These adjustments are: tuning adjustments on RF, IF, and, above all, the colour circuits and the little ferrite slugs in the coils. Random experimental adjustments to any of these will mean a trip into the workshop bench and a full realignment. The Master Technician *never* adjusts them until tests have clearly shown that they require it.

Checklist For Good Colour Installation

1. Picture – good black-and-white, no colour tinging (Grey Scale Tracking).
2. No coloured areas on screen (Purity).
3. No coloured fringes around objects (Convergence).
4. Colour Control – covers range from 'off' to too 'bright'.
5. Tint Control – should cause faces to go from greenish to reddish.
6. Fine Tuning Control – tunes from "worms" to a black-and-white picture.

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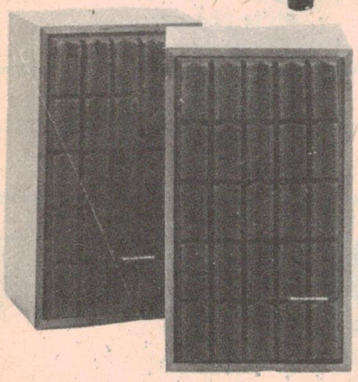

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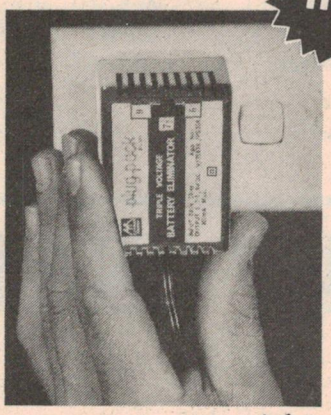

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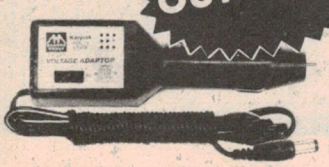

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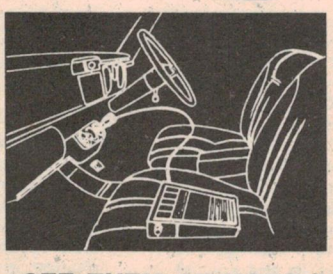

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The challenge of I^2L

A FEW YEARS AGO THERE WAS one principal technique used in the manufacture of logic circuits, namely TTl or Transistor-Transistor Logic. Devices using this technology have the advantage of being able to switch very quickly, but they are not suitable for applications like electronic watches where the logic circuits must consume very little power and occupy the minimum possible area on the silicon chip.

The development of the Complementary Metal Oxide Semiconductor technology known as CMOS (or COS/MOS) by RCA about 1970 provided devices which have an extremely high component packing density on the silicon chip and which operate at a very low quiescent current. The complementary MOS field effect transistors used in CMOS devices take appreciable current only for the time taken to switch logic states. Silicon-on-sapphire is a variation of the basic CMOS technology which offers relatively high speeds of operation, but at the present time such devices are expensive to manufacture.

I^2L

Integrated injection logic or I^2L now provides serious competition to CMOS circuits where minimum current and high component packing density is required. Devices using I^2L circuitry can be produced very economically and the speed of operation rivals that of TTL.

I^2L is being used for mass production of LSI ICs, but little has been said about the theory behind this new technology.

In this article Brian Dance explains how it works...

This new technology is being used by some of the major semiconductor manufacturers for products ranging from microprocessors to quartz-controlled electronic watch devices. All I^2L devices are large scale integration LSI products — they contain a very large number of components on a single silicon chip.

I^2L was developed quite separately (in Europe) by Philips and IBM around 1972. It employs bipolar devices (that is, devices like conventional transistors rather than FETs) in circuits which have been derived from the early DCTL (Direct Coupled Transistor Logic). It is only quite recently that developments in the I^2L production processes have made this circuit technique economically attractive.

A DCTL circuit is shown in Fig. 1. Three transistors are shown in each of the three NOR gates with the output of Gate 1 feeding one of the inputs of both gates 2 and 3. Other connections, which are not shown, are made to the other inputs of the gates. Circuits of this type were used in simple SSI (small scale integration) devices, but suffered from the disadvantage that the current was unequally divided among the transistors in any one gate owing to minor differences in their base-emitter voltages. In addition, the load resistor had to be separated from the transistors and this used up a considerable area of the chip.

Note that in the circuit of Fig. 1 there are direct connections between corresponding regions of the transistors: all of the emitters are joined together, whilst the two bases which are driven from the collectors of gate 1 are common. The current to these bases passes through the load resistor of the gate 1 circuit. In an I^2L circuit, these common electrodes share the same area on the chip.

A cross section through an I^2L gate is shown in Fig. 2 and the circuit is shown in Fig. 3. A single pnp transistor is employed as a current source to supply current to many transistor bases without the use of a load resistor. The whole of the emitter region is a

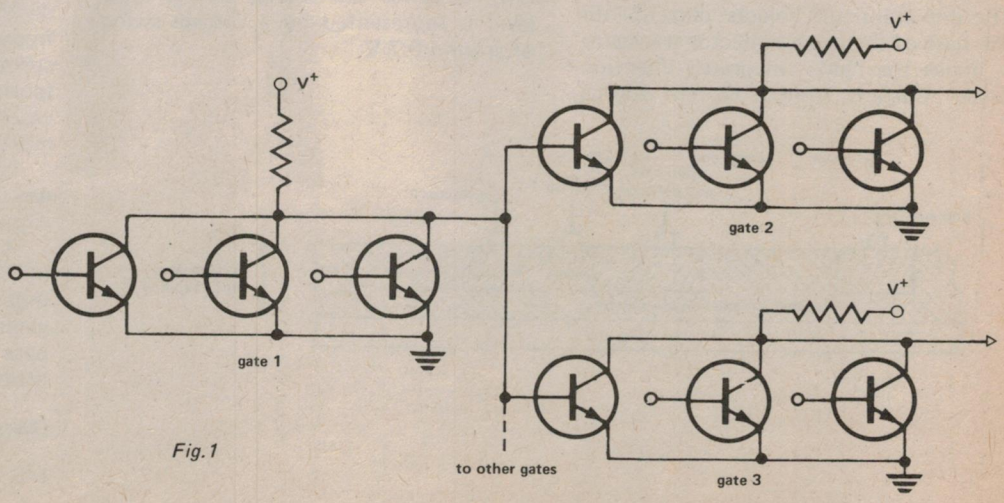


Fig. 1

The challenge of I²L

Table 1. A Comparison of TTL, CMOS and I^2L

Type of logic	Packing density (Gates/mm²)	Typical Quiescent dissipation per gate	Typical Dissipation per gate at 1 MHz	Logic voltage swing
I^2L	140 to 220	5 nW	100 μW	0.7 V
CMOS	70 – 80	5 nW	150 μW	Varies with supply voltage
TTL	20	10 mW	10 mW	3.5 V

common one beneath the surface structure on the chip. This eliminates the need for surface metallisation for each separate ground connection. In addition, the area required per transistor is greatly reduced. IBM initially used the name Merged Transistor Logic (MTL) instead of I^2L.

It should be noted that the pnp transistor is formed laterally along the surface of the silicon chip. The other component is a multi-collector npn transistor characteristic of I^2L devices. However, this npn transistor is formed vertically in the silicon. The n-type epitaxial layer acts as the grounded emitter of the npn transistor and also as the grounded base of the lateral pnp device. The p-type base of the multi-collector transistor also serves as the collector of the pnp device. Thus the two devices do not exist as separate structures.

Injection

The pnp transistor 'injects' current into the base of the multi-collector transistor – hence the name Integrated Injection Logic. Current from a current source (not shown in Fig. 3) passes to the emitter of the pnp transistor and hence to the collector. Switching of the logic state occurs when this current is switched to or from the base of the multi-collector transistor.

If the input at the base of the multi-collector transistor is low (less than about +0.7 V), this potential will be inadequate to overcome the natural forward junction potential of the npn base-emitter junction and the npn device will be non-conducting. The injected current will flow out of the input connection to the collector of the previous circuit (not shown in Fig. 3). The multi-collector transistor outputs will therefore rise to the 'high' logic level, this voltage being determined by the collector circuitry.

If the input voltage now becomes 'high' (that is, over +0.75 V), the npn transistor will be biased to saturation and the output of the collector will be 'low'. This low value can be about 0.02 V. Thus the change of the logic level is represented by a voltage swing of around 0.7 V.

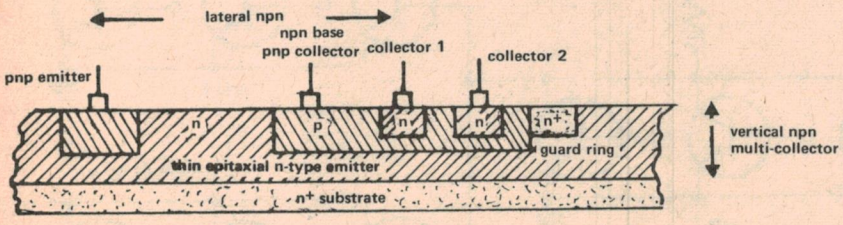


Fig.2

Power Supply

The positive power supply line of I^2L circuits is connected only to the emitters of the pnp injection transistors. The base of these transistors is earthed, so the I^2L circuit as viewed from the power supply line is effectively just a forward-biased silicon diode. The total power supply current is therefore the sum of the currents fed to the injection transistor emitters.

The voltage levels in I^2L circuits can be very low; indeed, such circuits can operate from a supply of 0.85 V upwards. The supply current per gate can be very low (about 1 nA), but the injected current can be increased in value up to about 1 mA to permit switching of the circuit at a much higher speed.

Although the I^2L circuits can operate at such low voltages, the input and output circuits normally included in the same package require a higher supply voltage and their requirements normally determine the operating voltage of the whole device. A series voltage-dropping resistor is used in the power supply line of some I^2L devices, whilst other devices incorporates a voltage regulator on the chip, to eliminate the need for an external resistor.

The use of an internal regulator circuit also enables various injector current levels to be obtained at different points in the circuit so that each part can operate at the minimum power level for the switching speed required by that particular part. For example, the fast frequency dividing circuits of a quartz controlled watch can operate at a high injection current for a satisfactory performance at 32 kHz, whereas the following frequency dividing circuits operating at a low frequency can use lower injection current levels. The increased cost of fabricating such circuits may be well worth while when current consumption must be minimised.

In many applications a single dry cell can be an ideal power source for I^2L circuitry.

A guard ring of n+ material (shown in Fig. 2) is required in I^2L devices to reduce cross-talk between adjacent gates. However, this ring can touch the base of the npn device and it occupies little surface area.

Gates

I^2L gates can be made by "wire-ORing"

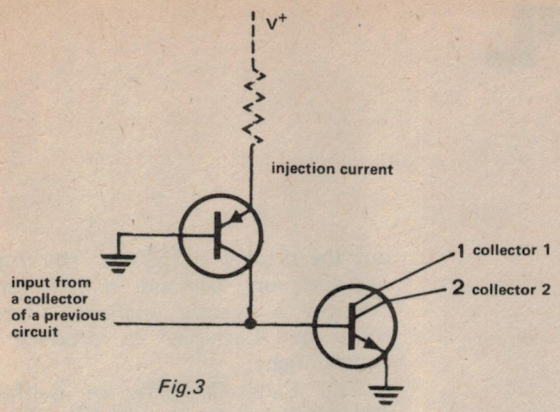


Fig.3

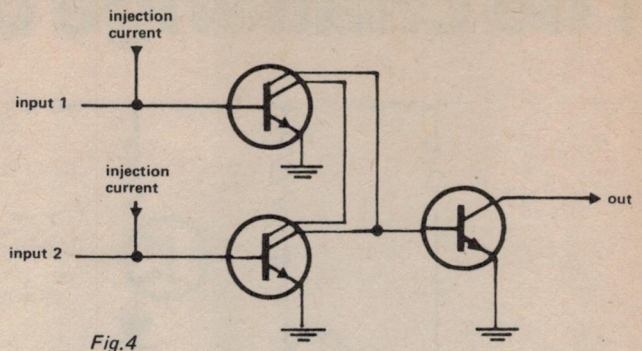


Fig.4

the isolated collector outputs as shown in Fig. 4. Similarly NAND gates can be made by using the multiple collector outputs of the npn transistor connected as shown in Fig. 5.

Input/Output Circuits

I^2L is almost always used in conjunction with other circuitry. The voltage change when an I^2L circuit switches is only about 0.7 V at current levels which may be very low. If the inputs and outputs of the I^2L circuits were brought out directly to external connecting pins, any small stray noise pulses or interference picked up by the circuit would be likely to trigger the I^2L circuitry, owing to its great sensitivity to low amplitude pulses.

Buffer interfacing circuits are therefore used between the input and output connections of a device and the I^2L circuitry itself. A typical input buffer which can accept TTL input pulses and convert them into pulses suitable for the operation of an I^2L circuit is shown in Fig. 6. The input buffer circuit used with some of the older logic systems can be even simpler.

An output buffer circuit which can amplify the low voltage pulses from the output of an I^2L circuit and provide enough current and voltage to drive a TTL input is shown in Fig. 7.

Technology Comparison

An I^2L gate can be made with what is effectively a single component on a chip area about one tenth of that required for a normal three-component CMOS gate. In addition, I^2L is one of the most economical technologies used in device fabrication, since the number of masking and diffusion operations on the silicon slices are less than in most comparable techniques.

One of the advantages of I^2L technology is that it is so very similar to that of other standard linear and Schottky TTL manufacturing processes that it is easy to fabricate other types of component on the same chip. For example, light emitting diode driver circuits can be built on the same chip as I^2L circuitry; this enables a single chip to be used to drive the display of a watch or a calculator as well as to carry out the required logic operations. Operational amplifiers, oscillators, voltage regulators, etc. can be fabricated on chips containing I^2L circuitry.

The CMOS process is essentially suitable only for the production of purely digital devices, although simple devices such as transistors and diodes can be fabricated on the chip. In contrast, Schottky TTL devices can be combined with I^2L circuits on a single chip to produce products which are faster and which have higher component densities than can be achieved in other ways. The Texas Instruments SN74S201 and SN74S301 256 bit random access memories are examples of such products.

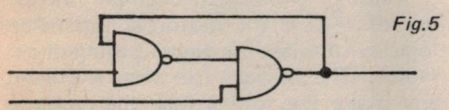
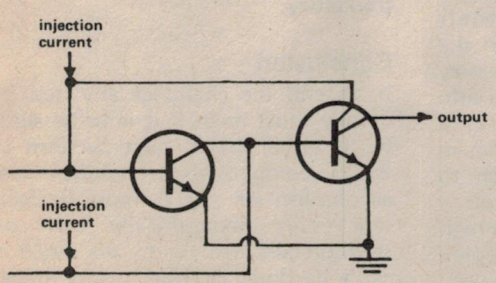


Fig.5



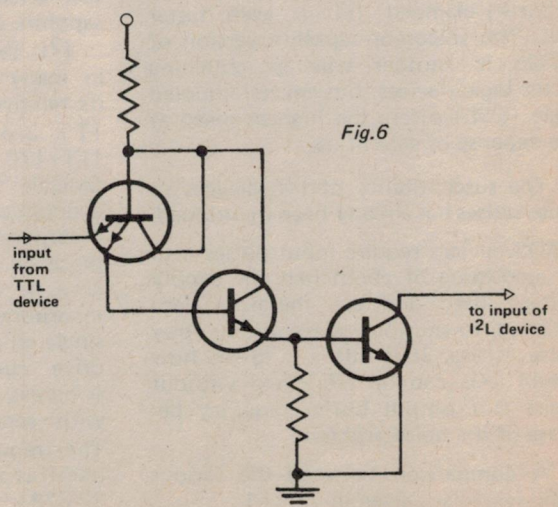


Fig.6

The challenge of I²L

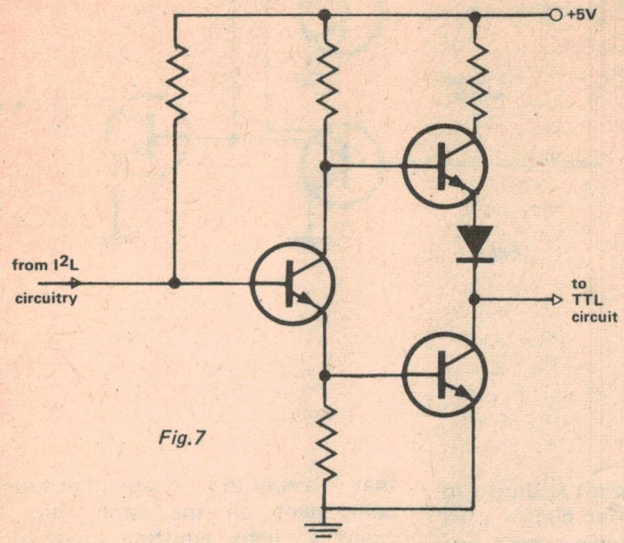


Fig.7

The power consumption of I²L circuits increases linearly with the speed of operation required and in practice you can use the minimum injection current required for maximum speed at which the circuits will ever operate. CMOS circuits consume very little power in the quiescent state, but the power required increases with the switching speed. Thus no circuit adjustments or settings need be made if minimum power consumption is important and the maximum operating speed is always available. In other words, CMOS circuits always consume minimum power at low operating speeds, but have a high speed capability "on demand" whereas I²L circuits must be adjusted for low power or high speed or some intermediate value of power consumption and speed.

I²L is faster than CMOS, whilst Schottky-clamped I²L is even faster still. The silicon-on-sapphire version of CMOS is another way of obtaining faster logic devices, but emitter coupled logic (ECL) offers the highest speed at the expense of ease of use.

The susceptibility of I²L devices to noise pulses has already been mentioned.

CMOS devices require input pulses with an amplitude of about half the supply voltage used and are therefore very resistant to spurious operation by stray noise pulses. It is difficult to see how future I²L can be fabricated without input and output buffer circuitry because of the noise problem.

A comparison between the various logic systems is given in Table 1.

Applications

I²L is employed in a wide range of applications which require large scale integration. It is unsuitable for making devices with only a few gates, so it seems most unlikely that simple I²L logic devices will become available (like those one meets using CMOS and TTL technologies).

I²L devices are expected to have a wide range of applications in the computer field. Although most of the larger semiconductor manufacturers are considering whether to become involved in I²L device manufacture, a few (such as Texas Instruments) are already producing devices in quantity. The SBPO400, for example, is Texas' 4-bit parallel binary processor element in I²L. I²L computer and microprocessor devices satisfy fairly high speed requirements, but they meet competition from fast versions of CMOS and silicon-on-sapphire devices.

I²L technology is likely to be used in many consumer applications where its relatively low price is a vital factor. ITT are already producing their ITT7170 device in England for the Sinclair "Black Watch" which is a very economical product. The 7170 chip incorporates over 2000 transistors on a piece of silicon only 3 mm ny 3 mm in area. It is used in the first watch to incorporate all of the circuitry on a single chip, since I²L can offer the high drive current for the LED display (whereas CMOS devices must be used with separate display-driver devices). The frequency of the quartz-controlled oscillator used in this watch is 32.678 kHz. Current consumption without the display is 159 μA. The display operates on demand and naturally requires a greatly increased current from the batteries to produce the emitted light.

The Exar Company of California also produce a watch using I²L logic.

Cameras

Another consumer field in which I²L seems destined to play an important part is in the electronic control of camera shutter speeds. Conventional electronic shutter devices consume a current from the battery in the camera whenever they are switched on, but I²L devices can be operated on the current from a photocell. Unfortunately a battery is required in such cameras to actually operate the shutter magnets, but the time for which the battery current is required is very small and hence new cameras employing I²L devices will have a much longer battery life than other types.

One camera circuit is made by Micro Components Corporation in Cranston, Rhode Island, USA. The I²L circuit operates as a light to frequency converter to produce an output of 100 Hz to 1 MHz, linearly related to the intensity of the incident light. This signal drives a ring oscillator made from I²L transistors which determines the shutter speed. The whole device is mounted in a clear plastic package consuming some tens of nA. The Matsushita Company of Japan are also working in this field using I²L.

Another consumer example of the use of I²L, is the Motorola three-chip logic synthesiser for digital tuning of car radios. The devices can scan the band and make the tuning lock the required frequency.

Conclusion

In th end the challenge any new technology must meet if it is to be successful is either (i) it must perform tasks which competitive techniques cannot accomplish or (ii) it must perform a task more economically than other technologies. I²L and do much that can't be done in other ways. However, in certain applications, it can be very cost effective. This criterion will determine in which applications it will be employed in the future.

Discovery of I^2L

The discovery of I^2L was quite a story in itself. Horst H. Berger and Siegfried K. Wiedmann of the IBM Boeblingen Laboratory in Germany reported on their MTL (or I^2L circuitry at the International Solid State Conference in Philadelphia in February 1972. However, the next paper at the Conference was by Cornelius M. Hart and Arie Slob of Philips Research Laboratories of Eindhoven, in which they disclosed details of their I^2L circuits.

The IBM workers produced their circuit designs after a long, but rational, effort. On the other hand, the Philips workers evolved their basic ideas within a few days in what was essentially a flash of inspiration. Within three months the Philips Laboratories were producing large scale I^2L chips.

Hart and Slob saw I^2L from the physicist's point of view in which minority carriers from a p region were injected into an npn device in order to solve the problem of the high current and large limiting resistors required with conventional bipolar logic. On the other hand, Berger and Wiedmann saw their circuits from the point of view of a circuit designer in which the individual devices on a chip were merged together.

The Philips organisation produced a pocket calculator using I^2L technology as early as 1971. It contained over 1000 gates in an area of4x4mm. Even in the first I^2L chips, the elimination of the physically large resistors and the thermal dissipation in these resistors showed the main advantages of I^2L technology. Each logical operation required about one picojoule of energy; this may be compared with the estimated value of 0.2 picojoule required to operate the logic cells (the "neurons") of a human brain.

I^3L

The symbol I^3L is a trade mark used by the Fairchild Company for their Isoplanar Integrated Injection Logic technology. It is employed in such products as the Fairchild 9408 microprogram sequencer which controls the order in which micro-instructions are fetched from a control memory having up to 1024 words; it is fully compatible with TTL devices.

Applications

I^2L devices are used in such applications as electronic games, frequency synthesisers, microprocessors, high speed calculators, computer interfaces, counters, timers, telephone switching, tone generators, electronic organs, remote control systems for TV sets, analogue to digital converters, digital voltmeters, vehicle anti-skidding systems, fuel injection control, etc. In Europe it can be used in the "Teletext" and "Viewdata" decoders.

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7413	.95	7474	.69	74154	2.50
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7416	.85	7476	.75	74160	2.20
7417	.95	7480	1.30	74164	230
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7425	.80	7483	1.80	74174	2.30
7426	.59	7485	2.50	74180	2.30
7427	.55	7486	.70	74181	4.90
7430	.39	7489	3.90	74185	3.90
7432	.55	7490	.65	74190	2.50
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74S20	1.40	74LS90	1.60
74S74	2.75	74LS92	1.60
74S112	2.50	74LS93	1.60
74S251	5.30	74LS95	2.15
74S258	4.75	74LS109	.70
74LS00	.45	74LS113	.70
74LS01	.45	74LS114	.70
74LS02	.45	74LS151	2.10
74LS03	.45	74LS157	1.95
74LS04	.49	74LS163	3.29
74LS05	.49	74LS164	2.35
74LS08	.45	74LS174	2.15
74LS09	.45	74LS175	2.15
74LS10	.45	74LS181	5.30
74LS11	.45	74LS191	3.50
74LS13	.99	74LS192	3.50
74LS14	2.35	74LS193	3.50
74LS20	.45	74LS194	2.15
74LS21	.45	74LS195	2.15
74LS27	.49	74LS196	2.15
74LS28	.49	74LS221	2.00
74LS30	.45	74LS253	2.20
74LS32	.55	74S196	2.80
74LS37	.55	82S23	6.95
74LS38	.55	8281A	3.90
74LS40	.49	82S90	5.95
74LS42	1.75	9001	1.60
74LS73	.59	9368	3.20
74LS74	.70	95H90	14.50
74LS75	.99		

DIODES ETC

AA119	.25	BZX61C13	.72
BA102	.60	BZX61C33	.72
BB105	.60	BZX70C15	$1.25
C103B	1.70	C122E	$3.50
C106D1	1.50	IN751A	.35
EM402	.20	IN752A	.35
EM404	.20	IN753A	.35

STOP PRESS

Since this advertisement was prepared early November, price rises resulting from devaluation have been passed on by our suppliers on varying bases. Some rises were immediate, while others were to be effective as new stocks were delivered. Our policy, since devaluation, has been to retain prices at old levels until we are actually charged higher prices for new stock. TIME DID NOT PERMIT ANY RISES TO BE INCORPORATED IN THIS AD AND IN MANY INSTANCES, PRICES WILL BE INCORRECT. We trust you will understand our predicament, and bear in mind that rises of up to 25% have taken place.

EM408	.35	IN754A	.35
OA91	.25	IN755A	.35
IN914	.10	IN759A	.35
IN748A	.35	IN5626	.65
IN749A	.35	MB4	1.80
BA114	.27	PA 40	4.90
BZX61C12	.72	SC151 D	2.50
V413	.95	OA47	.45
5082-2800	$2.50	OA90	.25
MEL12	$1.10	2530	.95
FCD820	$1.50	2530R	.95

+ others

CMOS

74C00	.45	CD4006	1.90
74C02	.65	CD4007	.45
74C08	1.10	CD4008	1.90
74C10	.50	CD4009	1.25
74C14	2.25	CD4010	1.20
74C20	.50	CD4011	.45
74C32	.65	CD4013	1.25
74C42	2.95	CD4014	1.90
74C48	4.95	CD4016	.75
74C73	1.90	CD4017	1.90
74C86	1.60	CD4019	1.10
74C89		CD4020	2.10
74C90	1.95	CD4026	P.O.A.
74C154	4.75	CD4027	1.60
74C160	2.95	CD4040	2.10
74C162	3.50	CD4051	1.90
74C174		CD4096	P.O.A.
74C901	1.50	CD4502	2.40
80C95	1.75	CD4053	P.O.A.
80C97	1.75	CD4511	2.75
CD4001	.39	CD4520	2.10
CD4002	.39		

+ others

PHILIPS LOCMOS — 4000-P

HEF4001	.45	HEF4066	1.20
HEF4002	.45	HEF4067	7.50
HEF4006	1.90	HEF4068	.45
HEF4007	.45	HEF4069	.50
HEF4008	1.90	HEF4070	.45
HEF4011	.45	HEF4071	.45
HEF4012	.45	HEF4072	.45
HEF4013	.75	HEF4073	.45
HEF4014	1.90	HEF4075	.45
HEF4015	1.90	HEF4078	.45
HEF4016	.75	HEF4081	.45
HEF4017	1.90	HEF4082	.45
HEF4018	1.90	HEF4085	1.35
HEF4019	1.10	HEF4086	1.35
HEF4020	2.10	HEF4093	1.50
HEF4021	1.90	HEF4104	2.90
HEF4022	1.80	HEF4510	2.65
HEF4023	.45	HEF4511	2.75
HEF4024	1.45	HEF4514	5.40
HEF4025	.45	HEF4515	5.40
HEF4027	.88	HEF4516	2.60
HEF4028	1.50	HEF4518	2.35
HEF4029	2.20	HEF4519	1.10
HEF4030	.80	HEF4520	2.10
HEF4031	3.90	HEF4528	1.50
HEF4035	1.95	HEF4539	1.65
HEF4040	2.10	HEF4555	1.50
HEF4041	2.10	HEF4556	1.50
HEF4042	1.60	HEF4724	3.20
HEF4043	1.90	HEF40097	1.50
HEF4044	1.90	HEF40098	1.50
HEF4046	2.60	HEF40174	2.40
HEF4047	1.60	HEF40175	2.40
HEF4049	.75	HEF40192	2.40
HEF4050	.75	HEF40193	2.40
HEF4051	1.90	HEF40194	2.40
HEF4052	1.90	HEF40195	2.40
HEF4053	1.90	HEF4076	2.85

Terms: Non-account customers cash, cheque, postal order or Bankcard.

LINEARS

CA3012	2.60	LM381N	3.20	SL621C	9.50
CA3013		LM382N	2.60	SL623C	17.40
CA3018	3.50	LM387N	2.75	SL624C	8.80
CA3023		LM395K	6.90	SL640C	10.60
CA3028A	2.60	LM555CN	1.20	SL641C	10.60
CA3035		LM555H		SL64SC	12.60
CA3039		LM556N	2.95	SL901B	3.90
CA3046	LM3046	LM562B	10.90	SL917B	6.50
CA3053		LM565N	3.50	SL1310	1.60
CA3059		LM566CN	2.50	SL3046	1.20
CA3060		LM567CN	3.50	SP8505	8.60
CA3079		LM709N	.95	SP8515	12.90
CA3080		LM710CN	1.25	TAA300	2.90
CA3081		LM710CJ		TBA570	2.90
CA3082		LM723H	1.70	TBA700	4.90
CA3083		LM723N	1.25	TBA810A	4.90
CA3086	LM3086	LM725N	5.90	TB1750A	3.90
CA3089	2.90	LM733CH		TCA220	2.25
CA3090Q	6.90	LM733N	2.50	TCA290A	4.90
CA3091		LM741CH	1.20	TCA420A	4.90
CA3123		LM741CN	.75	TCA580	6.50
CA3130T	2.25	LM747CH		TCA730	6.90
CA3140T	2.25	LM747CN	2.50	TCA740	6.80
CA3600		LM748CN	1.20	TDA1005	5.50
LM1144	4.90	LM1303N	2.60	VAA170	3.25
LM301AN	.95	LM1310N	3.50	UAA180	
LM301CN	.95	LM1458N	2.50	VA720	3.80
LM304H	3.80	LM1488N	6.90	VA723C	LM723
LM305AH	3.80	LM1489N	5.75	UA757	3.80
LM307N	1.60	LM1496N	1.90	ULN2208	2.45
LM308H		LM1808N	3.90	ULN2209	2.45
LM308V	2.20	LM3046	3.56	7805CP	2.90
LM309K	2.60	LM3086	3.75	7812CP	2.90
LM310H		LM3900	1.75	7815CP	2.90
LM310N	3.90	LM3905	3.90	7824CP	2.90
LM311A	3.60	LM3909	1.50		
LM311H		MC10358	2.90		
LM312H		MC1310			
LM317K	6.90	MC1312			
LM318N	5.90	MC1314			
LM319H		MC1315			
LM319N	5.90	MC1350	1.60		
LM320K	6.90	MC1351	2.95		
LM320T	4.50	MC1454G	5.40		
LM322N	4.50	MC1468L	6.50		
LM323K	7.90	MC1496K	2.75		
LM324N	4.50	MC1590G	6.75		
LM325N	4.50	MC1648P	4.90		
LM326H		MC4044	4.90		
LM339N	3.70	OM802	3.20		
LM340K	4.95	SAJ110	2.50		
LM340T	2.70	SAK140	2.50		
LM349N	4.50	SD305DE	1.30		
LM358N	3.20	SD306DE	1.50		
LM370H	4.95	SD6000V	1.95		
LM371N		SL415A	2.70		
LM372H		SL425A	1.80		
LM372N	4.50	SL437D	3.60		
LM373N	4.70	SL440	1.90		
LM374N	4.90	SL442	2.90		
LM375N	4.90	SL447	4.90		
LM377	3.50	SL449	1.60		
LM379	7.50	SL620C	9.50		
LM380N	2.75				

Most data sheets, technical info 30c photocopy or do it yourself on our coin-op machine 10c.

RESISTORS, POTS

½W	E12 Series	3c.
5W	E12 Series	45c.
S/G	LIN, Log	59c.
D/G	LIN, Log	1.25c.
Trimpots	Cermet	.40

DIL SOCKETS

8 PIN	.38	24 PIN	.78
14 PIN	.39	40 PIN	1.25
16 PIN	.45		

TRANSISTORS

AC125	1.80	MJ4502	8.90	2N5457	MPF103
AC126	1.80	MSF102	.65	2N5458	MPF104
AC127	1.80	MBF103	.85	2N5459	MPF105
AC128	1.80	MPF104	1.10	2N5485	MPF106
AC132	1.50	MPF105	.65	2N5590	MPF603
AC187	1.50	MPF106	1.15	2N5591	
AC188	1.50	MPF121	1.60	2N6027	1.35
AD149	2.60	MRF603	6.90	2N6084	17.50
AD161/162	4.50	TIP31C	1.20	40408	
AS322	.18	TI832C	1.30	40409	4.85
AS367		TIP120	3.20	40410	3.80
AT1138	2N2869	TIP125	3.30	40440	2N3731
ASY17	2.65	TIP142		40637A	2.85
BC107MET	.28	TIP147		40673	1.95
BC108MET	.28	TIP2955	1.70	40822	
BC109MET	.28	TIP3055	1.70	40841	1.90
BC177MET	.35	TT800	2N4037		
BC178MET	.35	TT801	1.20		
BC179MET	.35	2N301	2N2869		
BC182		2N706A	1.20		
BC212	.50	2N918	1.60		
BC327	.55	2N2222A	1.20		
BC337	.55	2N2646	2.50		
BC429		2N2869	2.70		
BC547	.55	2N2904A	1.50		
BC548	.55	2N2905	1.20		
BC549C	.55	2N2919			
BC559	.55	2N3053	1.20		
BC639	.1.20	2N3054	1.70		
BC640	1.20	2N3055	1.35		
BD131	BD233	2N3564	.65		
BD132	BD234	2N3565	.55		
BD139	1.20	2N3566	.95		
BD140	1.20	2N3568	.95		
BD237	1.80	2N3569	.50		
BD238	1.80	2N3638	.55		
BD437	2.80	2N3638A	.60		
BD438	2.80	2N3642	.55		
BF173	1.25	2N3643	.55		
BF180	1.20	2N3694	.65		
BF194	.85	2N731	5.95		
BF200	1.30	2N3819	1.35		
BFY50	1.20	2N3866			
BFY51	1.50	2N4037	1.25		
BPX25	4.90	2N4249	.65		
BSX19	.75	2N4250	.65		
BV126	3.90	2N4355	.65		
MFE131	1.95	2N4356	.65		
MJ802	8.90	2N4360	.95		
MJ2955	2.60	2N5245	.75		

CERAMICS

UP to 82 pf 11c. 100 pf to 0.47 µf 12c. .1 uf 12c. .22 uf 20c. .47 uf 35c.

DON'T FORGET – SUFFICIENT P/P AT LEAST 50c BALANCE REFUNDED

CHEAP BARGAIN COMPONENTS CAN FINISH UP VERY EXPENSIVE

First quality components and equipment from: AWA, Amidon, Elcoma, I.T.T., Motorola, National, RCA, Solid State, Signetics, Texas and others. Prices subject to change without notice. All offers genuine. Stocks subject to continued availability. All goods new to manufacturers specs. and guarantee. No rubbish, untested or unmarked devices. E.& O.E.

NEWEST DEALER... WESTERN SUBURBS NEWEST DEALER...

to buy at E.E.E.

DOLLAR — BUT WELCOME FRIENDS. FIND OUT FOR YOURSELF

Official orders accepted for trade sales.

BOXES — CASES

METAL	
108 x 108 x 50	$2.50
216 x 108 x 50	$3.75
PLASTIC	
PCI 135 x 130 x 70	$3.95
DIECAST	
95 x 120 x 55	$6.45
DELUXE	
160 x 165 x 70	$5.90

(ALLOW $1 P/P PER BOX)

LEDS AND DISPLAYS

SL5023	RED	.28
SL5253	GREEN	.80
SL5353	AMBER	1.30
NSN71 R/L	C/Anode	2.95
NSN74 R/L	C/Cathode	2.95
FND357		3.50

ELECTROS — AXIAL

.47/63V	.22	220/35V	.75
1/63V	.22	220/63V	.85
2.2/63V	.22	330/16V	.55
3.3/63V	.26	330/25V	.80
4.7/63	.26	330/63V	.85
10/25V	.26	470/16V	.65
10/63V	.28	470/25V	.85
25/25V	.28	470/35V	.90
22/63V	.35	470/63V	.95
33/16V	.26	1000/16V	.75
33/25V	.28	1000/25V	.95
47/16V	.26	1000/35V	1.20
47/25V	.30	1000/63V	1.80
47/63V	.45	2500/16V	.98
47/350	1.10	2500/25V	1.40
100/16V	.28	2500/35V	1.65
100/25V	.33	2500/50V	1.98
100/63V	.55	4700/35V	2.50
100/350	1.50	1000/63UR	2.35
220/16V	.45	2500/63UR	2.80
220/25V	.70	10000/40UR	6.00

TEST GEAR

Leader quality test gear.

Dip meter	$77
Ant. Z meter	$77
Sig. gen.	$70
Audio gen.	$117.30
Sanwa U60 D	$33.30

SPECIAL CHIPS

S 50242	$12.50
MA1002	$12.95

PLUS OTHERS PLEASE CHECK

TRANSFORMERS

A&R 2155A	6.95
FERG PL12/5VA	6.15
FERG PL1.5-18/20VA	7.60
FERG PF265	20.60
FERG PF3993	11.50
FERG PL30/5VA	6.90

PLUS MORE ASK FOR LISTING

C.O.D. Welcome.

PUBLICATIONS

Philips 1976 Catalog	$2.50
Simple Projects	$2.00
Top Projects	$2.50
Audio Projects	$2.00
Electronics Its Easy	
Vol I	$3.00
Vol II	$3.00
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Transistors	$4.75
CMOS IC	$5.90
Voltage Regulator	$5.90
Digital IC	$5.90
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Low Power Schotiky	$1.20
T.T.L. MS1	$1.20
Linear and Interface	$4.90
Orto Electronics Data	$4.50
TTL Data Book	$9.90
Supplement TTL Data	$4.75
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INSTANT COMPONENT SERVICE	
Stock Catalogue	$2.50
SIGNETIC	
1976 Data Manual/Notes	$11.95
Microprocessor Intro	$1.90

BREADBOARDS

Min IC	$6.75	SK10	$29.90
SK 50	$18.95	Ministrip	$1.90

TRIO

10 MHz dual trace CS1562	$436.00
15 MHz dual trace CS1560A	$483.00
30 MHz dual trace CS1570	$747.00
5 MHz 75 mm CO1303D	$167.00
SG402 RF SIG GEN	$82.00
AG202A CR OSC	$95.00
VT 108 volt-ohm meter	$92.00
DL 703 digital multimeter	$154.00
AG203 CR OSC	$162.00

Plus more ask for TRIO catalogue.
Plus 15 percent sales tax.
Ask about our finance from 10 percent Deposit to approved customers for sales over $300.

VALVES

WE STOCK VALVES AT COMPETITIVE PRICES.

PC BOARD

100 x 75 SS	.75
150 x 100 SS	1.20
200 x 75 SS	1.20
150 x 150 SS	1.60
200 x 150 SS	2.20
300 x 100 DS	2.90
300 x 300 DS	5.90

VEROBOARD

75 x 120	1.50
150 x 120	2.25
455 x 120	5.90
455 x 180	7.50

• Cut out or photocopy

MAIL ORDER

P.O. BOX 33, PENDLE HILL, NSW 2145

Name.....

Address.....

1 _____
2 _____
3 _____
4 _____
5 _____
6 _____
7 _____
8 _____
9 _____
10 _____
11 _____
12 _____
13 _____
14 _____
15 _____

TOTAL _____
LESS DISCOUNT _____
NET _____
POST/PACK _____
TOTAL $ _____

CHEQUE/BANKCARD BANKCARD — MAIL ORDER

If you wish, the full amount may be debited to your Bankcard Account. Your signature below is authority for us to issue a Bankcard sales voucher for the amount of the purchase (incl P/P) and an acknowledgement that the sales voucher, if endorsed MAIL ORDER may be treated as having been duly signed by you.

Bankcard No. 496.....
Expiry Date . . . . . /. . . . . /. . . .

Cardholder signature.....
Date . . . . . /. . . . . /. . . . .

Your Cardholder copy of the Bankcard Sales Voucher will be included with the goods despatched.

ELECTRONIC ENTHUSIASTS EMPORIUM

Shops 2 & 3, Post Office Arcade, 7-10 Joyce St, Pendle Hill. Mail: P.O. Box 33, Pendle Hill, 2145 (don't forget P/P) 636-6222. Mon, Tues, Weds 8.30-5.30, Thurs 8.30-7.30, Fri 8.30-6.00, Sat 8.00-12.30. Plenty of parking at rear.

ELECTROCRAFT PTY. LTD.

106A Hampden Rd.
Artarmon, 2064
Phone 411-2989

Distributors of Belling Lee, Channel Master, Ecraft, Hills, Hl.Q, Lab Gear, Kingray, Matchmaster. Largest Television range of aerial equipment in Sydney.

TELEVISION AERIALS, DISTRIBUTION AMPLIFIERS, EQUIPMENT AND ACCESSORIES WHOLESALE, TRADE AND RETAIL SUPPLIED.

ECRAFT

	Price
Neosid Balun 75/300 uncased	$0.65
O.S.A.B. Outside aerial balun (water proof)	3.81
6.SB 6ft. Balun Fly Lead	3.65
P.S.B. Plug and Terminal Balun	2.53
2.75.T/S 2-way 75 ohm Transformer Splitter	6.74
3.75.T/S 3-way 75 ohm Transformer Splitter	8.41
4.75.T/S 4-way 75 ohm Transformer Splitter	8.94
5.75.T/S 5-way 75ohm Transformer Splitter	12.66
2.3T 2-way 300 ohm Splitter box	4.48
3.3T 2-way 300 ohm Splitter box	5.86
4.3T 2-way 300 ohm Splitter box	7.12
Adjustable Low Band Attenuator Ch 2	5.33
10" diameter degaussing coil	24.00
Coaxial Plugs	46c

All Types of Coaxial Cable In Stock from 30c Per Yard.

TELEVISION AERIALS FOR COLOUR

CHANNELMASTER

9el Colour Crossfire 3615A	$43.64
13el Colour Crossfire 3614A	$54.69
17el Colour Crossfire 3613A	$68.17
21el Colour Crossfire 3612A	$78.54
24el Colour Crossfire 3617A	$99.84
28el Super Crossfire 3617A	125.73
Super Coloray the 3111 Ghost Killing Aerial	$41.98
2el Small Coloray 3110	$27.96

HILLS E.F.C. RANGE 75 ohm

E.F.C. 1 75 ohm	$31.43
E.F.C. 2 75 ohm	$41.70
E.F.C. 3/24 75 ohm	$60.64
E.F.C. 4/24 75 ohm	$76.30

HILLS THE NEW TELRAY RANGE—
All Australia V.H.F. Channels & F.M.

6el	TL1	$21.47
8el	TL2	$29.52
9el	TL3	$35.97
11el	TL4	$43.67

HILLS AERIALS

2010	Airways	$56.26
CA16	Phased Array	$44.36
Extra Gain Lift els for CA16		$ 5.01
8el	215	$24.42

HILLS AMPLIFIERS

D5/26 Dist: 26dB gain	$67.10
D4/16 Dist: 16dB gain	$59.37
MH2/75 Mast Head 20dB gain 75 ohm	$72.44
MH1/300 Mast Head 20dB gain 300 ohm	$54.90

FM AERIALS

Hills	2EL FM1	$ 9.39
HILLS	3EL 353	$12.98
Hills	3EL FM3	$18.27
HI-Q	4EL	$18.75
HI-Q	Gutter clip	$12.70
Matchmaster	G2FM	$19.29
Austenna	FM3F	$21.95

27 MHz high quality transceivers. Range up to 20 miles, 5 watts output. Switched PA suitable for dash mounting. Model G.M.E. 275 6 Ch's (Post Office Approved) $156.00
Model G.M.E. C555 23 Ch's $163.00

LAB GEAR AMPLIFIERS

VHF

	Price
Mast head 22 dB 75 ohm	$72.43
CM 6014/DA 20 dB	60.25
CM 6034/DA 4 outlets 8 dB each	54.90
CM 6036/DA VHF 30dB UHF 28dB	84.63
Televerta (VHF to UHF frequency converter)	67.48

KINGRAY AMPLIFIERS

	Price
D15/500 m/V	$48.80
D30/500 m/V	57.95
D40/600 m/V	79.30
D12/1500 m/V	67.10
MH 20 mast Head 300-75 ohm	64.63

TELESCOPIC MASTS

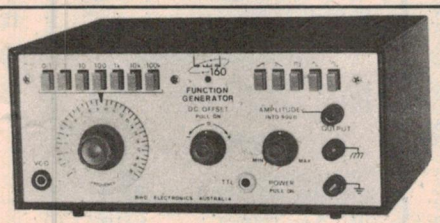
20ft	18g steel in 10ft sections must be guyed.	$19.30
30ft		$30.81
40ft		42.00
50ft		54.42

CDE AR.22 Rotator $79.00
Stolle Aerial Rotator with Thrust Bearing for heavier rigs $115.56

ALL TYPES OF HARDWARE IN STOCK
Wall Brackets, Chimney Mounts, J Brackets, Guy Rings & Guy Wire. Masts from 8ft to 50ft.

Some waveform 'economics'

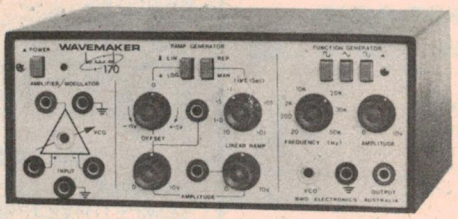
If you need to generate or measure waves, consider the economics of these instruments in meeting your needs.



Function Generator.
Twelve waveforms.
0.02Hz—2MHz
50Ω output impedance
Model bwd160A

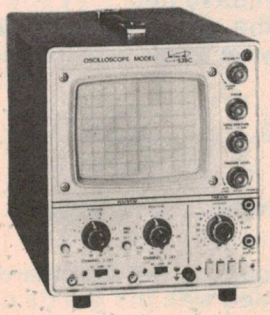
GENERATE

Oscilloscope,
6MHz Single Trace.
10mV—50V/cm.
Model bwd504



'WAVEMAKER'
Generator, modulator, multiplier, sweep.
20Hz—50kHz.
Model bwd170

MEASURE



Oscilloscope.
20MHz.
Dual Trace.
10mV—50V/cm
(Cascaded,
1mV/cm)
Model bwd539C

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W7

Metal glaze (cermet) resistors, wirewound and miscellaneous special types

Roger Harrison's series on components continues this month by looking at those types he hasn't covered so far — cermet, wirewound, and special types.

THESE RESISTORS ARE MADE BY fusing a suspension of metal and glass particles to a ceramic rod at temperatures between 750°C and 930°C. This forms a thick resistive film, fused with the surface of the ceramic former, resulting in a resistance element that is virtually impervious to environmental extremes of moisture, temperature, shock and vibration.

The fusion of the metal resistive material and the ceramic rod gives rise to the common name 'CERMET' resistor (usually pronounced Kermet, as in the famous frog from Sesame Street).

The construction of cermet resistors is generally the same as for film resistors: the desired resistance is obtained by spiralling the resistive element.

Owing to the high firing temperatures, these resistors may be rated for higher temperatures and loads than similar sized film resistors. Conduction of heat away from the resistance element is superior, owing to the better thermal contact possible between the resistance element on the rod and the metal end-caps. Body temperature rise is lower than for comparably-sized resistors of other types having similar ratings. As a result of these characteristics, cermet resistors are generally smaller than other resistors of the same rating. In fact, IRH Australia makes a miniature 0.5 W type (type GLP) only 5.5 mm long and 2 mm diameter!

The temperature coefficient of cermet resistors is generally comparable with most metal-film and metal-oxide resistors, common types having a TC of ± 100 ppm/°C. Some types exhibit a TC of +50 ppm/°C and may be as low as ±25 ppm/°C. This characteristic shows little variation with the value of the resistor.

Noise level for these resistors is generally higher than for other types, typically ranging from 0.4 μV/V to 1.0 μV/V, which is worse than other types but far below the level of carbon composition resistors. This level of noise is rarely a problem.

The voltage coefficient is generally better than 100 ppm/V, similar to most other film resistors and is not a consideration in the majority of applications. Generally, the voltage coefficient is only a consideration with carbon composition resistors.

As the construction of cermet resistors is similar to the other types of film resistors they have similar frequency characteristics. Values below 10k show little variation in value well into the UHF region.

Cermet resistors have excellent stability owing to body temperature being low for the amount of power dissipated. Figures of 0.5 — 1.0% are common. Generally, cermet resistors are manufactured in standard tolerances of ± 2% and ± 5%. Tolerances of ±1% are available on special order.

Like the common types of metal film resistors, metal glaze or cermet resistors have a hotspot or zero load temperature rating between 150°C and 160°C. They are derated linearly from 70°C as is standard with other film resistors. The derating curve for common types of cermet resistors is given in Figure 1. The miniature 0.5 W type (GLP), and some similar types by other manufacturers, have a hotspot temperature of 155°C, in common with various styles of metal film resistors and are derated according to the curve in Figure 2. Some styles have a dual rating. These are derated linearly from full power at 70°C to half power at 125°C, and then from there to 160°C, the hotspot temperature. The curve for these types is given in Figure 3.

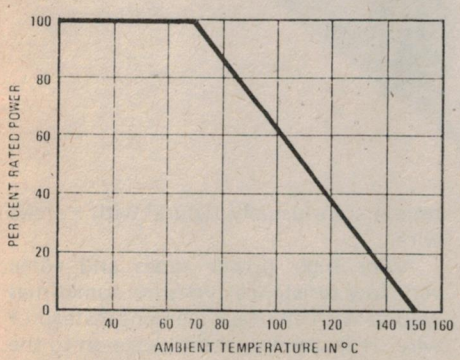


Fig. 1. Derating curve for most common metal blaze resistors - common to the majority of film resistors.

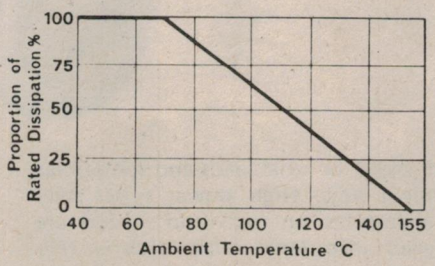


Fig. 2. Derating curve for miniature 0.5 W cermet resistor, type GLP; also applicable to some other manufacturers.

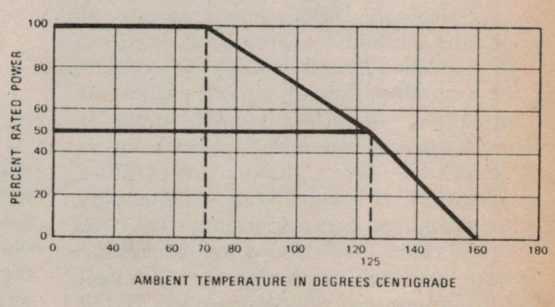


Fig. 3. Derating curve for dual-rated styles of cermet resistors.

Metal glaze (cermet) resistors

TABLE 4. General Characteristics of Metal Glaze (Cermet) Resistors

Rated Wattage @ 70°C	Max. Working Voltage	Max. Operating Temp.	Critical Resistance	Typical Sizes Length	Diameter	Typical Resistance Ranges
0.125 W (@125°C)	250 V	160°C	0.36 M	6.4 mm	2.3 mm	10Ω – 301 k
0.25 W	250 V	160°C	0.36 M	6.4 mm	2.3 mm	10Ω – 301k
0.33 W	350 V	150°C	0.12 M	10 mm	3 mm	10Ω – 270k
0.5 W*	250 V	155°C	0.36 M	5.5 mm	2 mm	2.2Ω – 470k
0.5 W	250 V	150°C	0.36 M	6.4 mm	2.3 mm	6.2Ω – 1 M
0.5 W	500 V	150°	82 k	14.3 mm	5.7 mm	10Ω– 270 k

*IRC type GLP – see text, miniature 0.5 W resistor.
(1) Wattage rating assumes voltage limit not exceeded.
(2) Max. Working Voltage assumes wattage rating not exceeded.
(3) Max. Operating Temperature is equal to hot-spot temperature.
(4) Sizes given are body sizes for axial-lead types.

Cermet resistors are generally available in ratings from 0.1 W to 0.5 W, and some less common types up to 5 W. Cost is comparable to most types of film resistors which makes them very attractive where their small size and high power rating is required or in applications where they are likely to experience moisture and temperature extremes, etc. Trimpots are manufactured having cermet resistance elements to take advantage of the ruggedness and resistance to environmental extremes that this type of element offers. The general characteristics of metal glaze or cermet resistors are illustrated in Table 4.

Wirewound Resistors

These resistors are made by winding a length of resistance wire on a bobbin (usually of ceramic or fibreglass), the ends being anchored to termination on the ends of the bobbin. Bobbins are usually cylindrical-shaped or flat. The bobbin and element are generally encapsulated in an impervious coat of vitreous enamel – some styles have the whole bobbin encapsulated in a square ceramic boat, having either axial or radial leads. These are generally the lower power types, up to 20 W.

There are two general types of coating applied to wirewound resistors. One is called Pyrosil D-Coat and consists of a combination of silicone resins and refactory material (which prevents oxidation) of the wire element) and is designed for high temperature operation. It is capable of withstanding temperatures corresponding to five times rated load. The other encapsulation material is known as Tropical C-Coat, another silicone compound and is designed to protect the element under extreme environmental conditions (particularly humidity). The power rating is different for similar resistors coated with different coatings. Resistors coated with tropical C-Coat can only operate at half the power of similar resistors encapsulated with Pyrosil D-Coat.

Terminations for wirewound resistors come in a wide variety of styles. The smaller, low power, types (particular the completely encapsulated types) often have radial or axial leads and sometimes terminal lugs. High power types may have ferrules on each end – and are plugged into large clips; alternatively they may have terminal lugs, Edison screw threads or flying leads.

The resistance element usually consists of nickel – chromium alloy wire (nichrome). Precision wirewound resistors are usually wound with Eureka wire.

Very high power types and some very low resistance types are sometimes wound with flat-tape element instead of wire. It is usually wound edge-on to the bobbin to improve heat dissipation from the element.

Wirewound resistors are made in

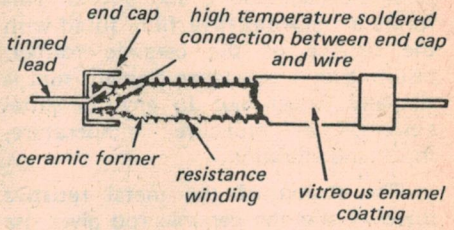


Fig. 4. Typical construction of small, cylindrical style wirewound resistor.

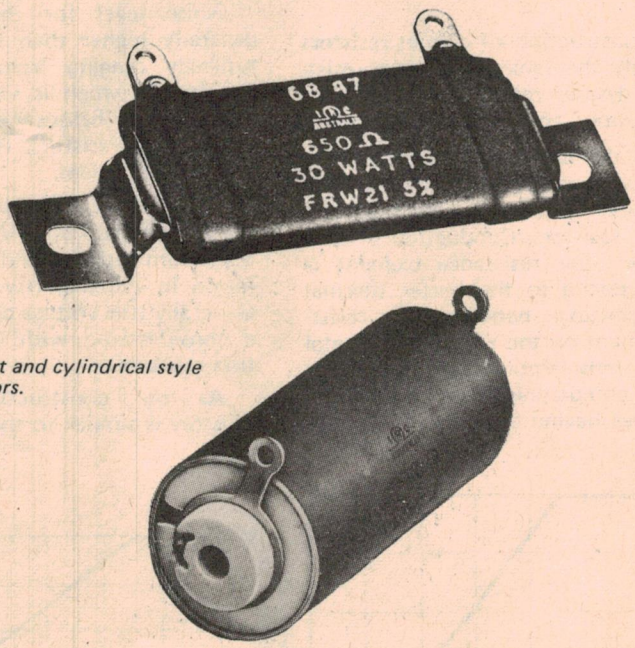


Fig. 5. Typical flat and cylindrical style wirewound resistors.

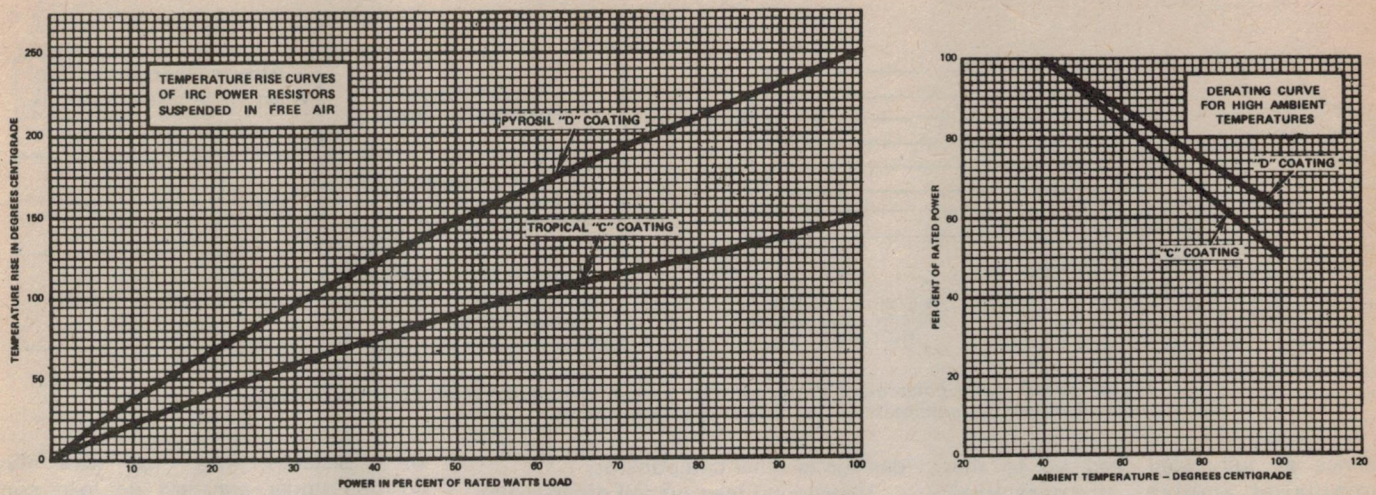


Fig. 6. Temperature rise and power derating curves for common cylindrical and flat style wirewound resistors.

wattage ratings to 250 W, commonly, and up to 1 kW or more for special applications. There are three basic construction styles: cylindrical, flat and encapsulated ceramic-boat style. The first two are also available as adjustable resistors, having portion of the element exposed and a moveable terminal in contact with it.

Wirewound resistors can have excellent temperature characteristics — as low as 5 ppm/°C, but generally less than 200 ppm/°C for the common types.

These resistors exhibit good stability, usually better than 2%, precision types having stabilities better than 0.05%. Common types are available in tolerances of ±5% and ±10% depending on construction style. Tolerance down to 1% can be obtained in precision types.

The noise level and voltage coefficient of wirewound resistors is negligible.

Owing to their construction, wirewound resistors are quite inductive and are generally only useful at low frequencies. Their inherent inductance can be decreased with special winding techniques — occasionally found in precision resistors, but as most wirewound resistors are predominantly used in dc and/or low-frequency circuits where their high power rating is required, this does not present much of a problem.

Wirewound resistors may be operated at temperatures up to 350°C but most common types have a maximum operating temperature (ambient + temperature rise due to power dissipation) of 290-300°C for Pyrosil D-Coat types and 190-200°C for Tropical C-Coat types. Temperature rise and power derating curves for the common cylindrical and flat style resistors are given in Figure 6. The power ratings are based on the ability of the resistor to give long

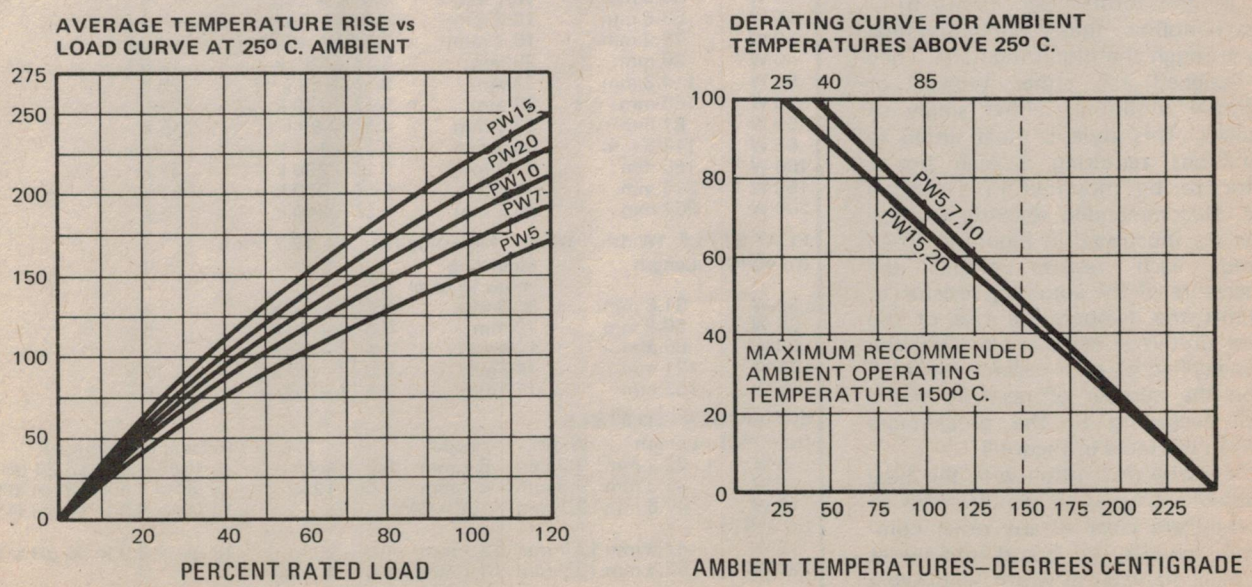
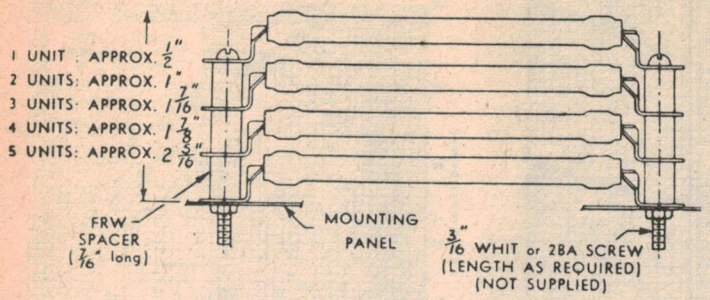


Fig. 7. Temperature rise and power derating curves for encapsulated (ceramic boat) style wirewound resistors.

Metal glaze (cermet) resistors



Kind of "Stack" Mounting Employed	% REDUCTION IN RATING When No. of Units Stacked Is		
	2	3	4
Resistors Stack-Mounted on a Horizontal Panel Reduce Rating by:	25%	45%	60%
Resistors Stack-Mounted on a Vertical Panel Reduce Rating by:	18%	30%	35%

Fig. 8. Recommended method of stacking the flat style of wirewound resistors and the necessary power derating. No more than four resistors should be in a stack.

service at full rated load up to the nominated ambient temperature. For higher ambient temperatures, the resistors are derated according to the curve shown. The full rated load is based on a temperature rise of 250°C from ambient of 40°C for Pyrosil D-Coat and a rise of 150°C from the same ambient for Tropical C-Coat. For the encapsulated lower power varieties, typical temperature rise and derating curves are given in Figure 7. These have a maximum recommended operating temperature of 150°C.

Care must be taken in the mounting of wirewound resistors to prevent the high operating temperature affecting surrounding components. The cylindrical types usually have a hole through the middle through which heat may escape by convection. Mounting these vertically where possible is recommended to keep their operating temperature down. The flat style are mounted using formed 'leaves' which fit into the ends of the former (see Figure 5) — which is hollow, these conducting heat away through the mounting bolts. They are designed for either vertical or horizontal mounting, either singly or in stacks. This style is most suited to applications requiring a high power resistor to be mounted in a limited space. Recommended stacking arrangements are illustrated in Figure 8. When stacked, each resistor affects the temperature of the adjoining resistor(s). To limit the temperature rise of the hottest unit it is necessary to limit the power applied to each resistor (depending on the number of resistors in the stack) according to the percentages shown in the table in Figure 8.

It is a wise precaution with the axial or radial-lead types to mount them so that they are clear of any other components, chassis, pc board, etc by at least their diameter or width, to provide sufficient ventilation and to prevent damage to other components.

Wirewound resistors fail occasionally. This may be due to one of the following reasons. In high value types, the resistance wire is very thin. The slightest blemish creates a weak point which may eventually cause the wire to break. In the coated types, expansion differences between the ceramic bobbin and the enamel coating may cause cracking of either the coating or the bobbin allowing moisture to penetrate and attack the resistance wire. The wire may corrode under constant dc load conditions due to chemical action in the enamel coating of the component. This latter problem is rare.

Precision wirewound resistors are wound on special bobbins, generally using Manganin wire, and encapsulated or covered in an insulating coating. They are sometimes epoxy-moulded. Other styles are hermetically sealed in a ceramic container. Wire leads or solder

TABLE 5. General characteristics of Wirewound Resistors.

Rated Wattage (D-Coat)	Typical Sizes (Overall)		Typical Resistance Ranges	
			Fixed Type	Adjustable Type (max.)
CYLINDRICAL STYLE				
(to 40°C)	Length	Diameter		
5 W	23 mm	10.3 mm	0.5 Ω – 5 k	–
10 W	44.5 mm	10.3 mm	0.75 Ω – 12 k	–
20 W	50.8 mm	16.7 mm	1.0 Ω – 25 k	5 k
25 W	63.5 mm	16.7 mm	1.0 Ω – 30 k	6 k
30 W	76.2 mm	16.7 mm	1.5 Ω – 40 k	7.5 k
40 W	89 mm	23 mm	3 Ω – 60 k	12.5 k
50 W	114.3 mm	23 mm	3 Ω – 88 k	20 k
75 W	165 mm	23 mm	5 Ω – 130 k	25 k
50 W	81 mm	33.3 mm	4 Ω – 80 k	16 k
65 W	114.3 mm	33.3 mm	4 Ω – 120 k	22.5 k
100 W	165 mm	33.3 mm	5 Ω – 200 k	37 k
150 W	216 mm	33.3 mm	5 Ω – 270 k	51 k
200 W	267 mm	33.3 mm	5 Ω – 340 k	62 k
FLAT STYLE (Width = 14 mm, Mounting Height = 12.7 mm)				
(to 40°C)	Length	Mounting Holes (ϕ to ϕ)		
20 W	31.8 mm	50.8 mm	0.5 Ω – 10 k	–
30 W	50.8 mm	70 mm	0.5 Ω – 25 k	6 k
50 W	89 mm	108 mm	1.5 Ω – 50 k	13 k
65 W	121 mm	140 mm	2.0 Ω – 20 k	19 k
75 W	153 mm	172 mm	2.5 Ω – 100 k	25 k
ENCAPSULATED STYLE				
(to 40°C)	Length	Width	Height	Inductance (typical)
5 W	22.2 mm	9.5 mm	8.7 mm 0.5 – 4.7 k	5.1 μH @ 900 Ω; 20 μH @ 3.3 k
7 W	35.3 mm	9.5 mm	8.7 mm 1.0 – 12 k	8 μH @ 2.4 k; 33 μH @ 9 k
10 W	47.6 mm	9.5 mm	1.0 – 20 k	13 μH @ 3.9 k; 56 μH @ 15 k
(to 25°C)				
15 W	47.6 mm	12.7 mm	12.7 mm 1.0 – 20 k	13 μH @ 3.9 k; 56 μH @ 15 k
20 W	63.5 mm	12.7 mm	12.7 mm 1.0 – 4.7 k	

lugs are used as terminations. Precision wirewound resistors are not generally designed to dissipate power. Power types are available however, generally consisting of a conventionally constructed wirewound resistor wound to a tight tolerance or selected, and mounted in an extruded aluminium case. This assists heatsinking, allowing precision resistors to be rated up to powers of 200 W.

The general characteristics of the three basic styles of wirewound resistor are illustrated in Table 5. Typical inductance values for the lower power, encapsulated styles are also given for low and high values.

Miscellaneous Special Types

Special applications call for resistors having particular characteristics. Special resistors are manufactured, taking advantage of certain properties of different materials or construction techniques, to meet the requirements of applications outside those normally found with ordinary resistors.

High voltage circuitry requires resistors having very high maximum working voltages (up to 50 kV in some cases). RF applications require resistors that substantially maintain their dc value up to quite high frequencies as well as being able to dissipate considerable power. Various special resistors having controlled non-linear temperature or voltage characteristics are also useful in a variety of circuit applications.

High Voltage Resistors

High voltage resistors generally have higher values than the normal range of resistor types. Values up to 10^{13} ohms are available.

They are constructed of a carbon-composition film applied in helical form to a ceramic tube, resulting in a long conducting path. The element may be mounted in an evacuated glass envelope or coated in a special varnish. The helical element provides a uniform pitch allowing a uniform voltage gradient between turns throughout the length of the resistor.

They find application in voltage-multiplier probes, high voltage bleeders, CRT circuits, photocell cicuits, ionization equipment etc. They can be obtained in voltage ratings up to 50 kV and wattage ratings from 2 W to 100 W.

Ferrule, terminal lugs and wire lead terminations are available depending on style and application.

Typical temperature coefficients range between 50 ppm/°C and 700 ppm/°C for low resistance values and high resistance values respectively.

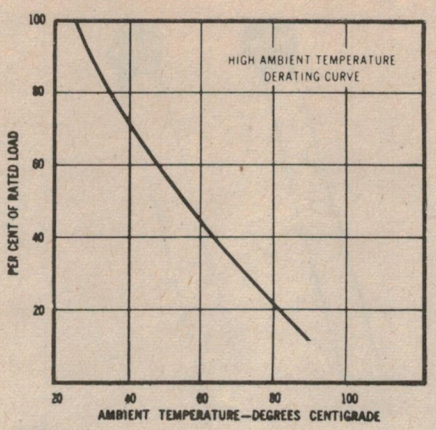


Fig 9. Power derating curve for high voltage and high frequency resistors.

High voltage resistors generally have a hotspot temperature of 100°C although this is much greater for forced-air cooled and oil-cooled types occasionally encountered. Those operated in free air are derated from 25°C as indicated in Figure 9. Note that it is non-linear.

These resistors are available in values ranging from 2k5 to 10^5M generally, higher values by special order.

Dimensions depend on wattage rating and intended application.

High Frequency Resistors

These resistors have a specially designed resistance film which provides optimum performance on all desired characteristics while operating up to quite high frequencies. The cross-sectional are of the resistive element is kept small (less than 0.3 mm!) to assure low inherent capacitance and freedom from skin effect. The resistance element is generally not spiralled in order to reduce inductance effects.

Terminal bands of colloidal silver are deposited over the ends of the resistive element, forming a permanent, low-resistance contact. Axial-lead, terminal lug or ferrule terminations are attached to the silver bands, as required. A protective coating encapsulates the entire resistive film.

These resistors maintain their value well into the UHF region, mounting usually limiting its performance. Values up to 300 ohms vary less than 20% from their nominal dc value up to 400 MHz. Values up to 3k3 vary less than 20% up to 200 MHz. The nominal value decreases with frequency.

These resistors find extensive application as RF dummy loads, antenna terminating resistors etc, and in radar pulse equipment. They are available in wattage ratings up to 100 W and as low as 1 W; values from 20 ohms to 130 M (useful at low frequencies to 100 kHz) and voltage ratings to about 10 kV. They are derated from 25°C in free air, as per Figure 9, and have a hotspot temperature of 100°C – more if forced-air cooled or oil cooled.

Thermistors

Thermistors belong to a group of resistors made from semiconductor materials and are thermally sensitive, having a controlled temperature coefficient that may be positive (PTC thermistors) or negative (NTC thermistors).

Thermistors are widely used for temperature measurement and control, temperature stabilisation, current surge suppression, and a wide variety of other applications. They are non-reactive and non-polarised and are therefore suitable for use in either ac or dc circuits.

The resistive element consists of barium titanate in PTC thermistors and various metal oxides in NTC thermistors. The compounds are sintered into special shapes, depending on the required application. They are formed into small elements in a variety of shapes -- generally discs, rods, blocks or tubes. They may be encapsulated simply with a varnish or epoxy or inside a glass or metal tube. Some types are not encapsulated at all.

PTC thermistors are available in two basic characteristics. The 'A' characteristic type exhibits linear change of logarithmic resistance values against temperature. The 'B' characteristic exhibits abrupt increase of resistance when the temperature increases above a specified value, showing only small change in resistance below this temperature.

Some typical PTC thermistors are illustrated in Figure 10. Individual characteristics are best obtained from manufacturers' literature.

NTC thermistors are available covering a wide range of values and temperature ranges. They are available as two basic types – directly heated and indirectly heated. The directly heated types consist simply of the NTC element with two leads (see Figure 11). Some types have a metal or glass header surrounding the element. A typical

Metal glaze (cermet) resistors

type, made as a water temperature sensor, is also illustrated in Figure 11. Indirectly-heated types consist of an NTC element integrally mounted with a heater.

Voltage Dependent Resistors

These resistors are generally known as 'Varistors' and are another type of semiconductor resistor, They are principally used as voltage surge suppressors, some types being used in voltage stabiliser applications.

The element generally consists of a sintered ceramic material, the most common types zinc oxide as the main ingredient. Other types employ elements containing titanate ceramic (sometimes known as 'variatite') or silicon carbide (SiC varistors). The common types are often referred to as ZNR varistors from Zinc Oxide Nonlinear Resistor.

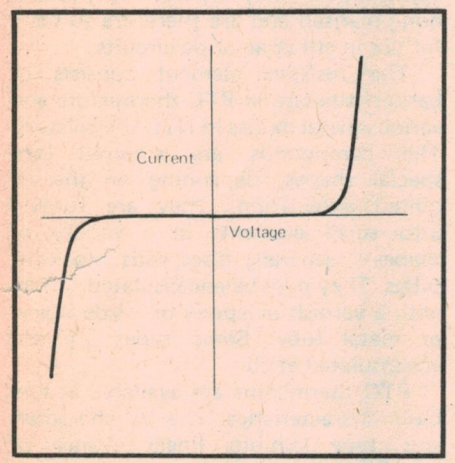


Fig 12. Varistor voltage-current characteristics.

The general characteristics of varistors is illustrated in Figure 12. They are available in a wide variety of encapsulations, some are illustrated in Figure 13. They are often found as 'spike' suppressors in solid state TV sets, as back-emf suppressors across relays, and in rectifier circuits protecting rectifiers from voltage surges.

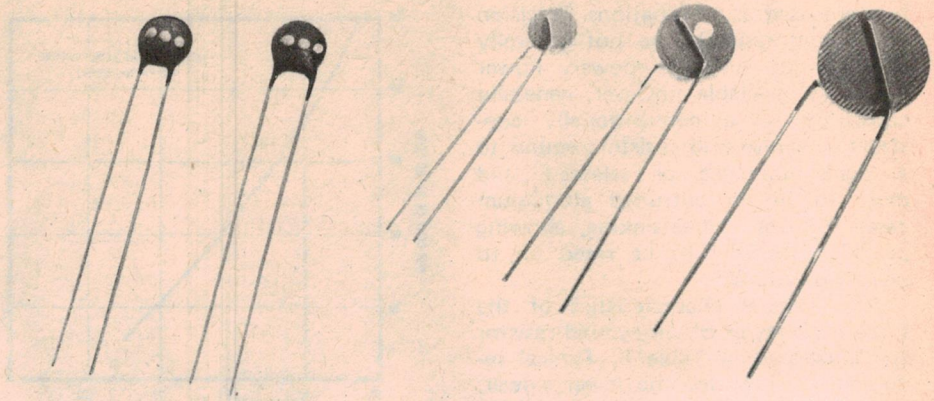
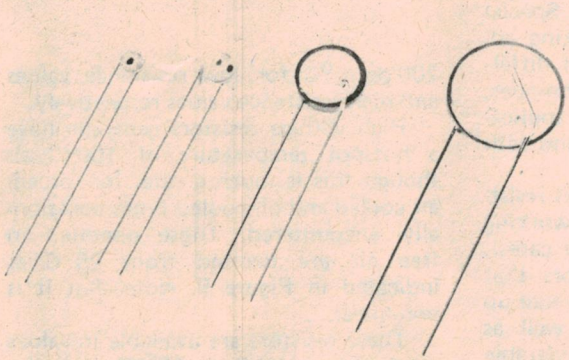
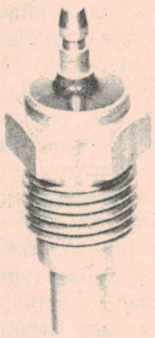


Fig. 10. Typical PTC thermistors (actual size).



(varnished)

Fig. 11. Typical NTC thermistors.



(bare)

NTC element as automotive water temperature sensor.

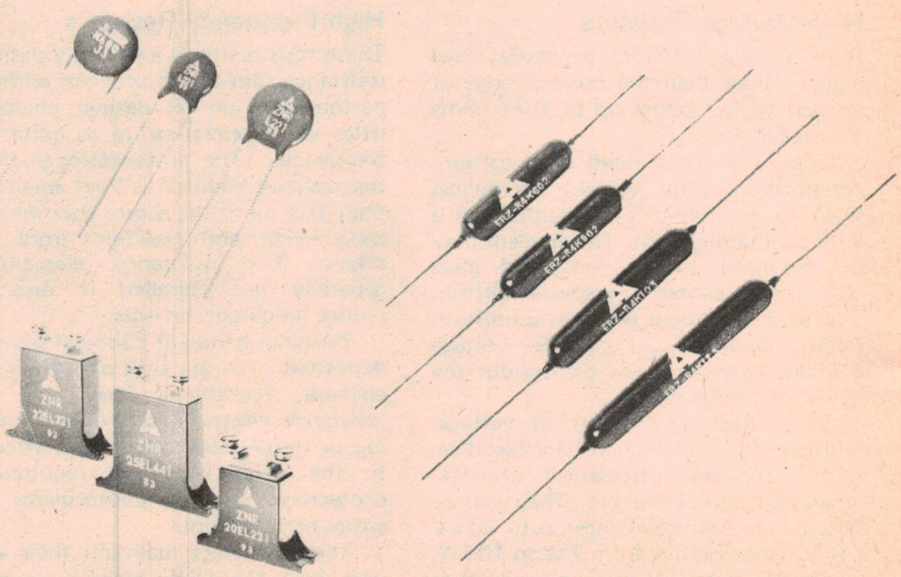


Fig. 13. Various types of varistor encapsulations for different applications.

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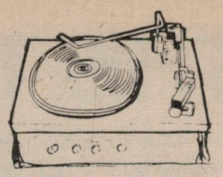

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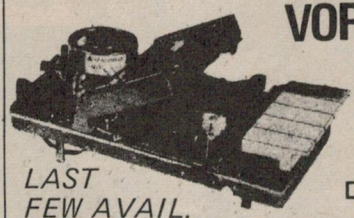

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☐ 380V		AC 11P	3-10	2-48	2-23	2-05
☐ 12,24,110V		DC 8P	2-30	1-84	1-65	1-54
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The Command CD4003 3W per channel tuner — amplifier features VOLUME, BASS, TREBLE, BALANCE controls, 5pin din tape record/play socket, headphone and 'slumber" switch. Technical features include the latest National LM377 dual IC chip, 3 trans AM broadcast tuner and crystal or ceramic cartridge input. The tuner-amp is ready-built and includes a de-luxe wood-grain base to accept either Garrard or BSR turntables. A perspex cover and hinges are available at just $10.50 extra. ☐ A Garrard 6-200 or BSR C141 turntable are available at only $29.00 each (only when purchased with the tuner-amp, normally $36.00) ☐.

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Read carefully and you may get some idea why leading overseas magazines use DENON turntable when doing critical cartridge evaluation; why 2MBSFM use DENON and why the Japanese NHK Broadcast Network standardise on DENON.

SPECIFICATIONS

Drive system: Direct-coupled motor. Speed: 33-1/3 r.p.m.
45 r.p.m. Speed control: Servo system through frequency detection. Speed selection:
Electrically switched. Starting time: 1.8 seconds at 33-1/3 r.p.m. Turning angle: 180° (1/2 turn).
Wow/flutter: Less than 0.03% (w.r.m.s.). S/N: Over 60 dB. Turntable: Aluminium alloy diecast. Diameter:
300mm. Weight: 1.1kg. Speed adjustable range: ±3% of specified speed. Power requirement: AC220/230/240V,
50/60 Hz changeable. Power consumption: 14W. Total dimensions: 20-7/8" (530 m/m) W; 17-21/64" (440 m/m) D;
7-3/32" (180 m/m) H. Total weight: 22.7 lbs (10.3 kg). Specifications are subject to change without notice.

● Speed detection with DENON's original, high-precision,, magnetic speed-sensing mechanism
Equipped with a unique speed-detection system, the DP-3500 determines rotational speed with extreme accuracy and momentary response. The inner rim of the platter is provided with a magnetic coating of high magnetic reluctance, on which 1,000 pulses are recorded around the rim with a spacing error of 1/10,000 precision. As the turntable rotates, a magnetic head detects pulse signals and regulates the motor servo-control. The pulse frequency detected at 33-1/3rpm is approx. 550 Hz, resulting in more than ten times the resolution obtainable by other methods. At 33-1/3rpm, platter acceleration from stop to rated speed is within half a turn. The lightweight turntable reduces bearing load, offering stable performance over extended periods.

● Stable rotational speed
An effective servo-circuit incorporating a DC regulator circuit boosts loop gain and fully compensates the temperature, promising constant, stable rotation of the turntable against fluctuation of input power frequency and voltage as well as variation of temperature and stylus force.

● 70mm-thick plywood cabinet for minimized resonance
Since the player cabinet is made of 70mm plywood, cabinet resonance is minimized, producing comparatively less vibration while playing.

● Built-in insulators with adjustable length
By adopting four insulators which have been newly developed to absorb external vibration, the player is constantly supported firmly to produce an ideal acoustic effect. Insulator length can be adjusted to offer a stable, horizontal turntable position.

● Replaceable, generous-sized arm board
The generous-sized arm board can support a tone arm up to 350mm long. It is easily replaceable by removing the four screws. A choice of standard arm board or optional ones meet customer's requirements for any type of tone arm desired.

● Handsome dust cover
The attractive acrylic resin dust cover protects the player mechanism from dust and dirt. The 4mm-thick acrylic resin sheet minimizes howling. Knobs on both sides facilitate opening or shutting the cover, removable by one-touch operation.

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PART 3

ELECTRONICS IN THE YEAR 2000

EVOLUTION OR REVOLUTION

By Peter Sydenham

MAJOR CHANGES THAT COME about in our lifestyle and attitudes are usually the result of basic needs being recognised by some agency that has the resources to bring such changes about. We begin to use new products of technology when both the need emerges and the technological availability to fulfil it is available. Progress can come from either direction: either as technology developed to meet a big enough need or a need being exploited because a new technology has become available. In both instances our society has generally, in the past, helped this process where economic or political gains are to be had. Not all developments are as good as they are promoted to be and many excellent concepts fail to catch on because the cost expended cannot be regained. In too many instances the quality of the promotion given to a new device or technique is the key to its acceptance. In numerous instances the inherent quality of the product is not a factor in people's minds when selection – the act of helping the idea gain a hold – is made. Communication and its off-shoot, entertainment, are aspects of life which are very susceptible to over-promotional effort (what Dorothy Parker once described as worship of the fecund rate).

In order to extrapolate and, perhaps, predict some breakthroughs in communication method in the future century we can and should look at ideas from the two progress motivations above – what we need and what we could be given.

The Role of Communication

Communication is needed to enable information to be imparted from one person to another person (Fig. 1). It is the act of passing information from point to point. An energy medium is always needed for information to pass. Some messages mean more than others, even though they may have the same number of words – a phenomenon not definable in scientific terms. We do have a good idea, however, of the carrying capacity, of a given communication channel. To do this we ignore the *meaning* of messages and concentrate on their *'bit' content.* On this basis – the Shannon concept – it is easy to see that facts containing many 'bits' of information will need a communication method having the required 'bit'-carrying capacity – this turns out to be the available frequency bandwidth in electronic communication techniques. Increasing the bandwidth usually means an increase in cost, so many potential communication needs are limited by economic reasons, not technological ability to provide bandwidth. As an example, for cost reasons, we make do with telex and telegram messages written in stilted format doing without the facial and tonal expression of face-to-face communication. A better alternative would be to use a video-link (such as may one day be in widespread use) instead of the teleprinter, though such a thing requires around 10 000 times more bandwidth. Figure 2 shows a unit that has been on trial since 1971.

The pattern of current civilisation requires people to interact as a living system of coordination, cooperation and coexistence. This means people need to communicate with each other. Usually the closer that a man-made

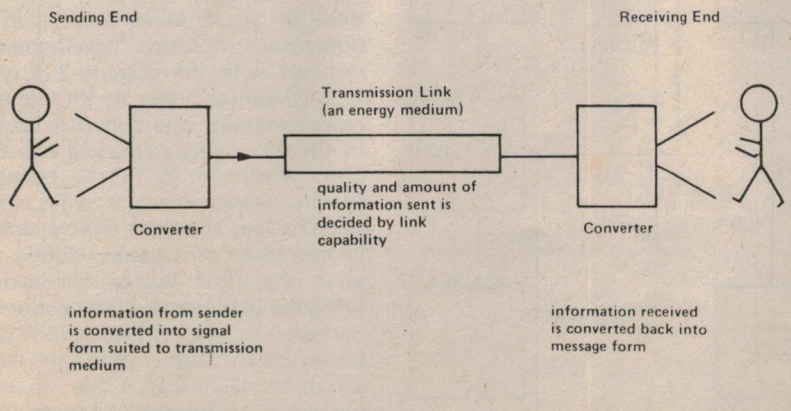


Fig. 1. A communication link conveys preset kinds of information from one point to another using an energy medium as the carrier.

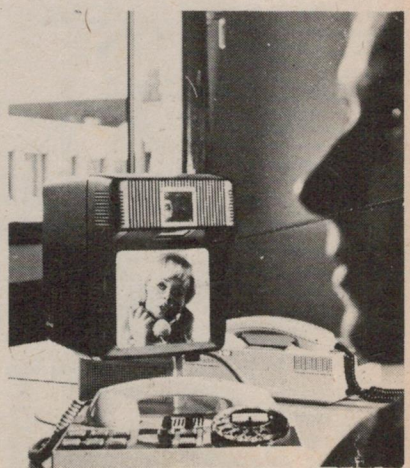


Fig. 2. Video links provide a greater communication capability but require more bandwidth than a telephone. (This Siemens experimental system uses 1 MHz).

Electronics 2000

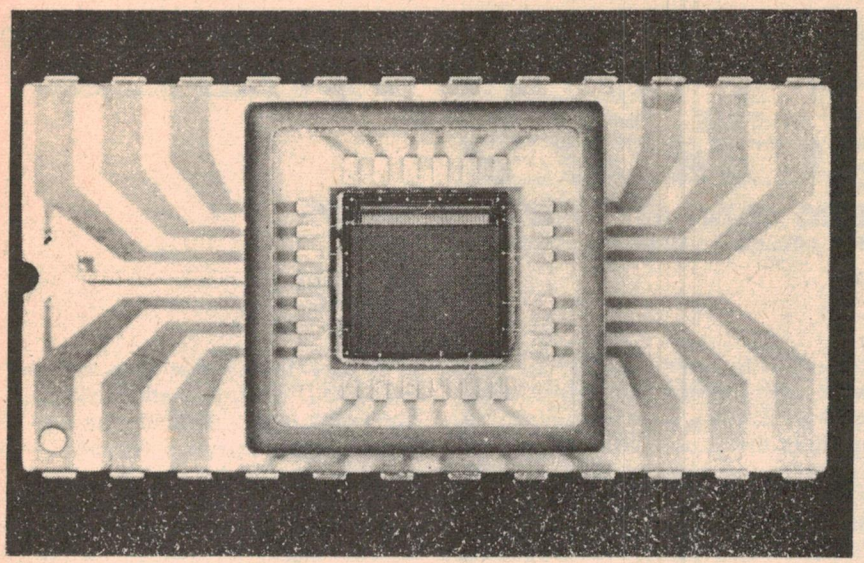
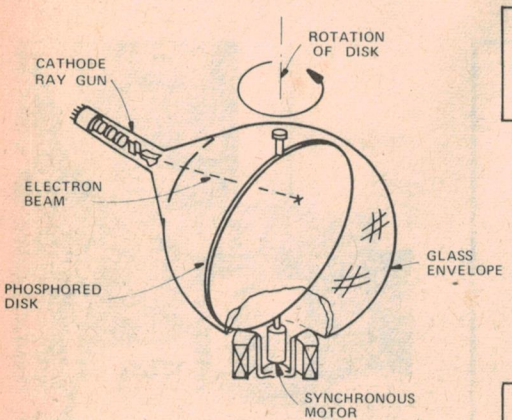


Fig. 3. Solid-state sensing array research is paving the way to tricolour LED panel televisions of the future. This unit has 64 x 64 photo diodes integrated into 6 mm square.

communication link can approach the real face-to-face case the better. Our awareness is enhanced as the simulation provided by the communication link is made more and more a true image of real contact.

Distances, cost and time often make direct communication unrealistic, so technology is brought to bear to reduce the inconveniences. Communication is needed to make commercial and political decisions, to fulfil social needs, to provide education and to entertain. In each of these the hardware forms are similar – it is the use to which they are put that may influence improvement.

The telephone grew from commercial needs for faster and more informative communication than was offered by telegraphy (which, in itself, was a vast improvement over hand-carried letters) but by contrast television grew because of its consumer market in the entertainment and news media fields. A few video-links have been established but the great operating cost limits them at present more to mass-audience needs, such as inter-city television interviews, than to telephone replacement.



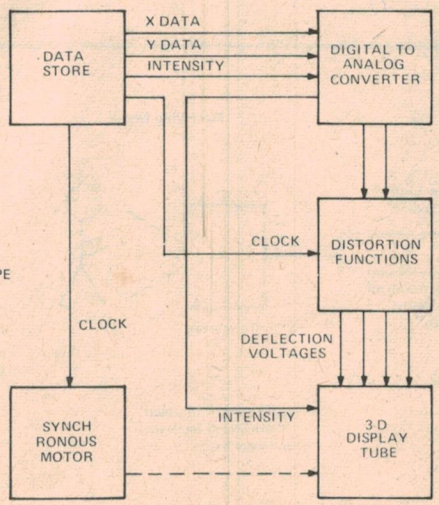


Fig. 4. 3-D display from a special CRT – a 1960's invention helping progress into 3-D television (Courtesy Electronics).

Expected Hardware of the Future

The area where greatest development in communications will be seen must be in the forms and use of the domestic television receiver. The receiver itself is sufficiently inexpensive for the majority of people in the developed countries to expect to own a set. We would, therefore, expect little more development on the receiver itself from the point of view of need-induced research.

Styling and operation changes will be prevalent in keeping with promotionally-induced change brought about by manufacturers who must keep seeking markets. Future receivers will most surely incorporate solid-state screens comprising millions of light emitting diodes giving the three primary colours. These screens will be flat and of insignificant thickness – they will be suitable for wall mounting like a picture. The receiving and processing circuits will be integrated onto the same panel. The concept of a television set as a piece of furniture will vanish. This development is currently at the very small monochrome (black and white system) stage – see Fig. 3 – with cameras, rather than displays, being the point of emphasis. The size will gradually increase to acceptable proportions after or during which colour solid-state systems will emerge. The cost of the technology, not its capability, limits this approach at present. IBM have made a 1 m x 1 m area of light sensitive diodes that has close to the current 625 line television resolution. At present, however, the cathode-ray tube method is the only economic technique for generating the picture in a television set.

Because visual experience is in three dimensions, not two, development will not rest with the current 2-D systems. A 3-D cathode ray oscilloscope trace representation was demonstrated back in the 60's using a rotating phosphored disk as shown in Fig. 4. Holography (details were given in ETI, January, 1974) using coherent light enables 3-D images to be generated in colour as well as in the usual red experienced when using the helium-neon laser source.

Barriers to the introduction of 3-D television are both cost and the lack of a suitable technique. We have no obviously acceptable systems in existence at present. We can expect the usual period of multiple source development which will generate many alternatives

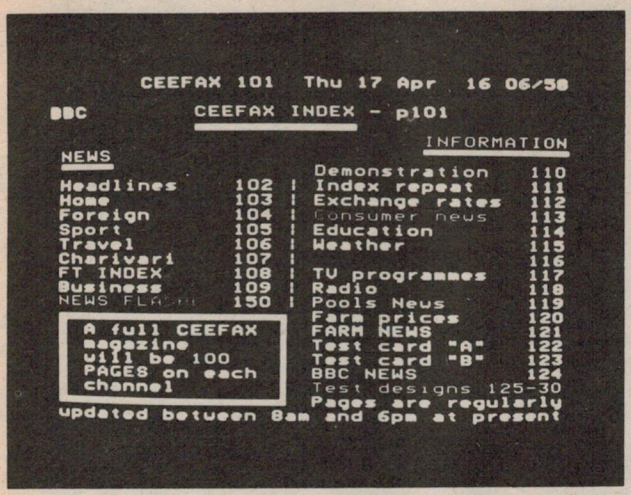


Fig. 5. Index page of earlier CEEFAX page system now available on domestic television in the U.K.

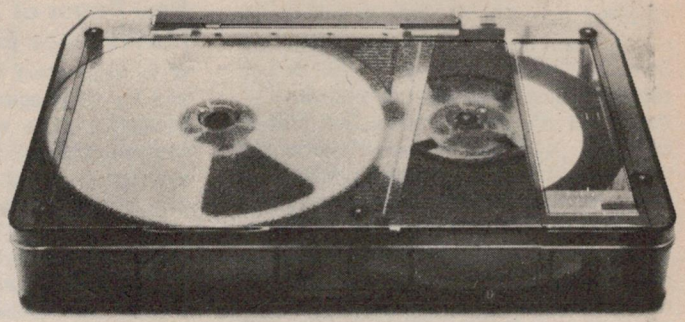


Fig. 6. This Sony cassette gives one hour of colour television with soundtracks using a domestic television receiver to display the output of a special replay tape deck. Recorded television will replace books in the future.

in the outset before one or two methods settle-out to become the norm.

Returning to more obvious extras for use with the domestic television set we will very soon see widespread use of the currently developed systems which transmit information over a spare part of the television channel. In the CEEFAX and ORACLE systems the data is stored until a complete single frame of written or pictorial information is ready to show. A more recent version is TELETEXT (see ETI, February, 1976). Television network operations in Britain have systems working well past the prototype test-state. Any television set owner (who can build or purchase a decoder unit) in Britain can today obtain up to several hundred full 'page' items on the screen. Items such as the weather forecast, share market figures, programmes, time and programs reviews are listed. Figure 5 gives just one of the selection. It is not hard to see that this offering logically extends to giving access to an enormous amount of information. Newspapers may be largely replaced by this means, and once the volume run of a newspaper falls too low it will be too costly to produce and therefore will disappear completely.

The t.v. monitor of the future will also become the domestic equivalent of the micro-film/micro-fiche reader now rapidly replacing the book in liberaries and storehouses. Recorded video-tapes can be quite cheap to replay on special purpose replay-only units. Such units have been available for about five years now and it will not be long before the cost will be such that we will be buying video as well as audio cassettes in the music shop. Video disks are also close to being marketed in large volume. Figure 7 shows one market contender for the consumer market – prototype development having been reported three years ago.

One day in the future we will be visited by salesmen selling encyclopaedias in video cassette form instead of as bulky books. The publishers will also be able to offer an exchange service – old cassettes can have their facts updated at minimal expense.

Perhaps, too, the monitor will become the terminal for optimal video-links added to the telephone. For this to occur we would need low-cost very-wide bandwidth telephone channels. Current open wire and cable telephone systems have inadequate bandwidth handling capabilities on a single line so the change to video phones would need an entirely new concept of transmission or a complete replacement of the telephone cable network including the switching and processing plant installed within the telephone system. The bigger the capital invested the longer it can take to change to new technology.

The bi-motional mechanical selector

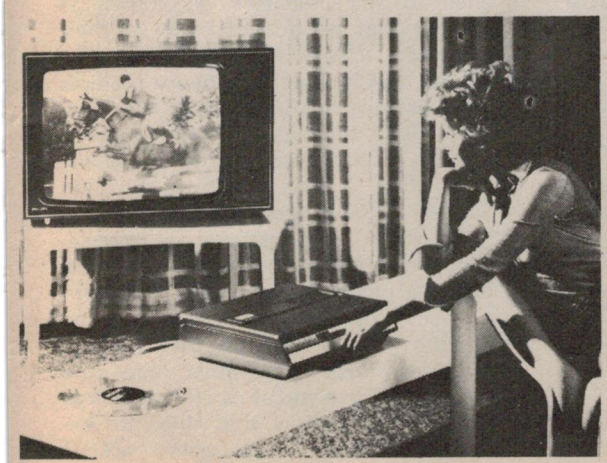
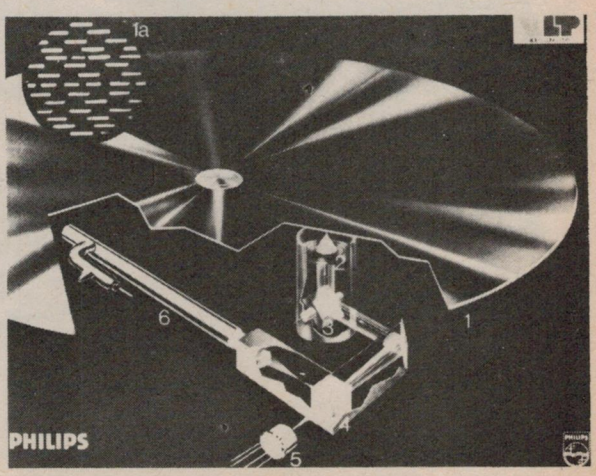


Fig. 7. Video record playing equipment is already developed. Records provide 10-45 minutes of colour television.



Electronics 2000

switches (see Fig. 8) used in telephone exchanges were first patented by Strowger in 1891. Many are still in use today because of economic reasons.

A spread of the currently introduced cable-t.v. systems – small networks wherein other than broadcast television programmes are 'sold' to clients connected to a specific suburban network of coaxial cables – as shown in Fig. 9 – might eventually duplicate all local telephone cables with adequate video-bandwidth networks. This would set the scene for a gradual change to videophones. There will still, however, remain the immense task of providing national and international bandwidth capability that is 10 000 times its current provision for not much more in cost to the user.

Laser beams sent along fibre-optic paths are often reported to be the answer to bandwidth needs: considerable research and development is being performed today on these technologies. If and when their price falls enough to be competitive with other wide-band systems, the first places of application will most likely be in heavy-traffic telephone and video links between cities. Domestic application, on the other hand, (in the form of cable-t.v.) is an area where developers will be able to influence change more rapidly due to the smaller clientele to satisfy and persuade.

New Forms of Transmission Medium may Emerge

It is instructive to go back in history and try to imagine the attitudes of 18th century people to the likelihood of a communication form other than by message or word of mouth. To people of that era, sending messages over electro-magnetic EM waves would have been fantasy indeed. They knew and had some understanding of acoustic waves but knew nothing of radio waves. In the 19th century Maxwell predicted from his mathematical understanding of magnetic fields and their observed local-field behaviour, that it was possible to radiate a field away from a source – the energy literally escapes from the generator. It took about thirty years for this idea to be verified (by Hertz) by a crude experiment (see Fig. 10) and out of this was born radio (see ETI, March, 1975, April, 1975). Once the concept of the electromagnetic spectrum was realised, EM frequencies other than in the radio region were exploited for communication purposes. Even today we have not completely filled in our use of all EM radiation wavelengths.

Field theory is a generalised theory that handles any kind of effect that can be experienced in space – magnetic, electric, gravity and force fields are examples. The operative word is 'experienced'. Until Hertz demonstrated radio waves no one had experienced them and, therefore, they did not exist as a tool of technology. Perhaps, today there are similarly other methods of radiation, so small in magnitude and so alien to any detectors we possess at present that we do not know of their existence. There is much evidence to suggest this is the case. Theory predicts the existence of gravity waves which are force fields propagated from exploding galaxies. On a more closer basis we know that a mass exerts a force on another mass by gravitational attraction (but why is an unknown of science. The force falls off as the square of the distance between the masses. In theory a small mass (the transmitter) vibrating rapidly causes a minute varying attractive force on another mass (the receiver). These forces can be calculated and the sums show that they are exceedingly small if the masses are of

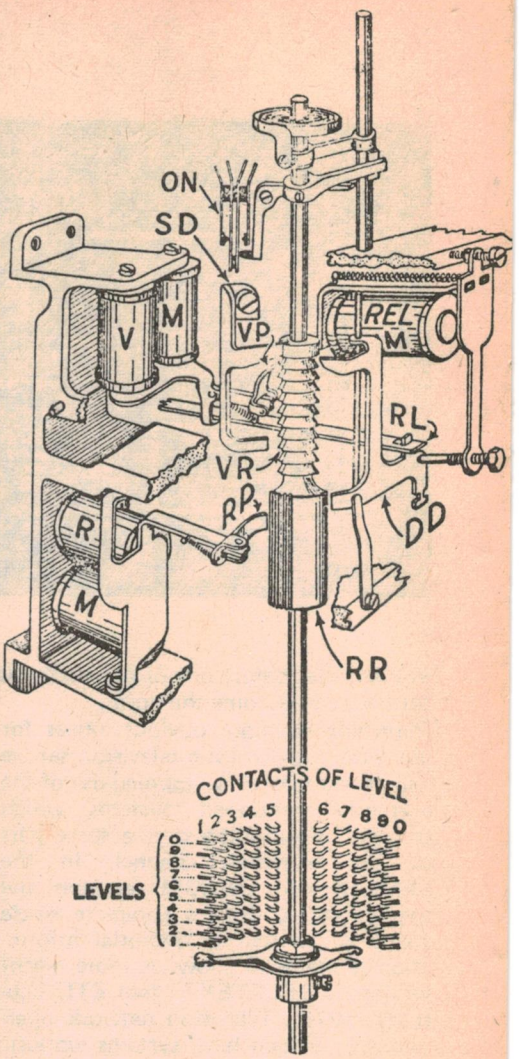


Fig. 8. Strowger bi-motional selector switches were first patented in 1891. Today many telephone exchanges still use them because it is uneconomic to change to new technology.

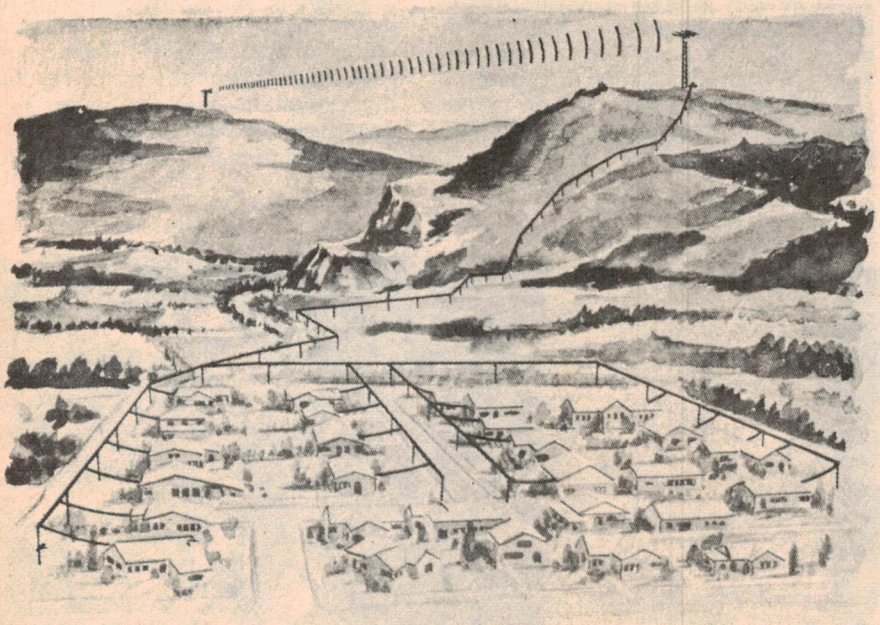


Fig. 9. Cable t.v. will provide local networks with adequate bandwidth for videophone use: it may influence the use of long-distance video links.

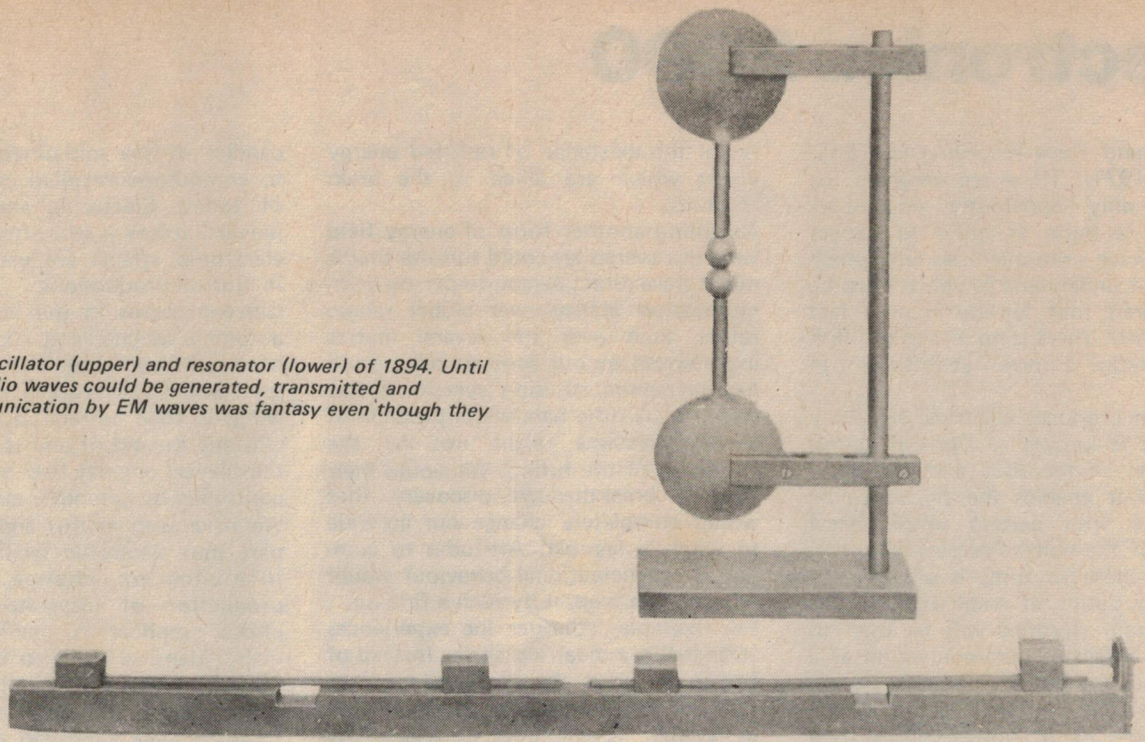


Fig. 10. Hertz oscillator (upper) and resonator (lower) of 1894. Until Hertz proved radio waves could be generated, transmitted and detected, communication by EM waves was fantasy even though they existed.

reasonably small size. To date many scientific research projects have tried to detect macro gravity – wave effects from the galaxies but now it appears that the current mechanical detectors being used are clouded by their own internal Brownian motion, which appears as a noise source. A new detection principle is needed – a second Hertz type historical event will occur one day when, and if, the generation and detection of gravity waves is demonstrated providing practical experience of the effect.

Moving on to less theoretically based fields there are the photographs made of energy fields of objects. These are unexplained but it is fact that photographs taken in a special way reveal an 'aura' surrounding the object. Lack of understanding of such phenomena is not an adequate basis for saying they are necessarily fakes.

Extra sensory perception ESP also may be part of potential future communication. Perhaps it, too, makes use of an energy field we do not yet recognise. It is sobering to remember we only understand experiences that our physiological senses and brain allow us to observe. ESP, mental-telepathy, clairvoyance, precognition and parapsychology contribute physical experiences such as levitation, materialization, automatic writing, spirit photographs, psychokinesis, apparitions, poltergeists,

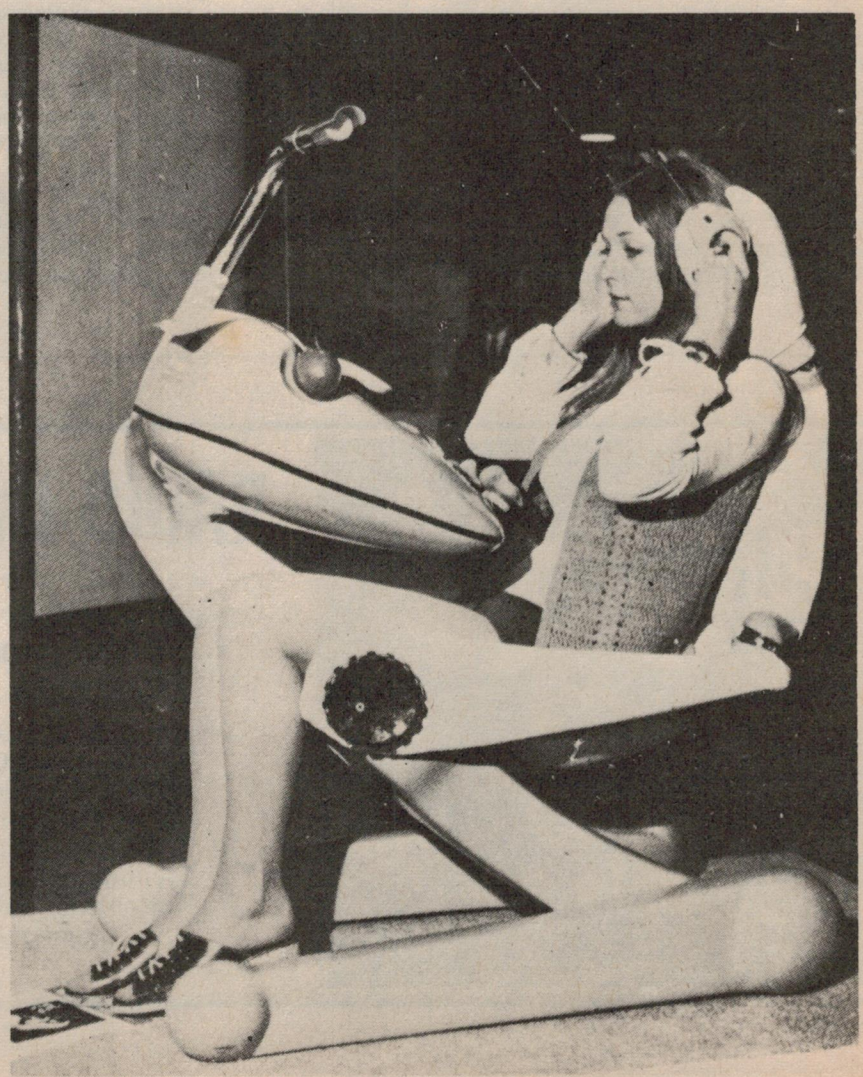


Fig. 11. This Luigi Colani integrated office could be the basis of a Year 2000 automatic writer operated by brain-waves.

Electronics 2000

miracles and voice recording (see ETI, August, 1971). These are observed (or perhaps only apparently observed?) facts. It is quite in order to expect them to have a rational basis, one which we cannot understand as yet. It must be remembered that fantasy is only fact unexplained. There is no reason to think all knowledge is known at this point in time.

The brain produces electrical signals — one kind is known as alpha rhythms. These can be recorded and a little is known that enables the signals to be associated with certain physiological actions of the body. Progress of understanding these rhythms is positive but slow. No doubt at some time in the future brain rhythms will be used to produce extensive communication as a direct thought process between people and machines — see Fig. 11. If we could hook up to another person by a wirelink it would be clearly feasible to do so without wires using wireless techniques of today. Typewriters that write directly from thought waves will emerge to speed up the tedious task of transducing thought into clearly printed text. Here the old-up is a scientific knowledge barrier for we cannot adequately decode the rhythms to obtain any more than the most simplistic data about the person's functions. Perhaps allied research will reveal the existence of radiated energy waves which are allied to the brain rhythms.

Assuming another form of energy field were discovered we could surmise that it might have direct person-to-person communication ability over global ranges rather than over the several metres experienced by our acoustic talking and hearing communication system. If this were so then the bandwidth problem of current systems might not be the limitation of the future. We would then have a breakthrough discovery that would completely change our attitude to what is feasible. Attitudes to community participational behaviour would be completely upset by such a finding.

For example, consider the experiences arranged in a theatrical show. Instead of having to relay the performance over cable or EM systems we might be able to 'attend' from remote distances. The whole concept of theatre would change. For this to be an adequate experience the "distance attendance" form of participation must fully simulate actual participation in the audience. Such a capability would obviate a vast amount of travel necessity and vastly reduce the need for transport mechanisms.

The live theatre is one form of entertainment that has changed little since its inception — at least until recent times. Lighting has improved past candles of the mid-nineteenth century to computer-controlled electric lighting of today. Electronic amplification of players' voices is still often avoided but electronic effects are used extensively in musical productions.

Current moves in the industry are to automate set changing. At the command of a mini-computer the several tonne sets will soon trundle out from the wings to their correct positions on stage without the aid of any stagehands. Will the players one day become automatons controlled by computer also?

We have seen in this and the previous part that electronic facility is a major influence on change. The mass-production of integrated circuits by photo replication methods enables many identical parts to be made most cheaply. Cheap data processing will continuously influence the kinds of ideas that are exploited and promoted in the future. One interesting question to ask, however, is whether electronics is the only discipline for powerful information handling. In the 1940s mechanical elements were thought to be the answer; today it is electronics. Could tomorrow see a change to electro-chemical or some other system of signalling not yet known?

In Part 4 we will investigate likely medical developments and the impact of the computer on the whole of life style.

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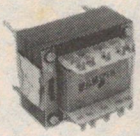
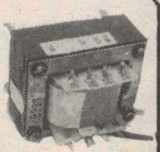
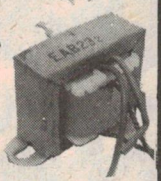


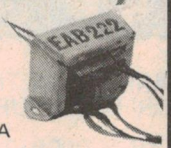
MSC217 Pri: 240 or 254VAC Sec: 64 & 6.5V at 1amp. $4.00 each.
MSC218 Spec's as above but at 1.5amp. $4.75 each.



MSC235 Pri: 230/240 & 254VAC Sec: 64V & 6.3V at 400mA $4.00 each.

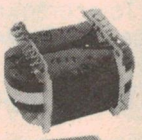


MSC232 Pri: 240 or 254VAC Sec: 50V CT & 6.3V at 250mA $3.50 each

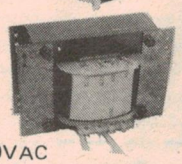


MSC222 Pri: 240 or 125VAC Sec: 26V CT & 5.9V at 20mA $2.00 each

MSC203 Pri: 240 or 254VAC Sec: 36V CT & 6.3V at 250mA $3.00 each

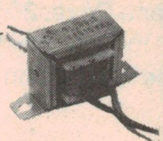


MSC225 'C' Core transformer. Pri: 240 & 254VAC Sec: 36V & 5.3V at 1 amp. $6.00 each



MGE03050 Pri: 240VAC Sec: 117V at 300mA plus 5.7V and 20V at 3amp. $7.00 each

MGE03046 Pri: 120 or 240VAC Sec: 34V at 50mA $2.50 each



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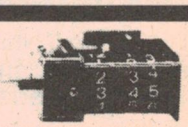

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A slightly more sophisticated version of the Sidewinder 1. Has the same features of the above unit but has the addition of a Delta Tune plus/minus 1 kHz. Complete with Microphone and Lead & Mounting hardware.

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ACCESSORIES – ANTENNAS

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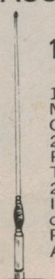
100-R Trunk Mount. Overall length: 43½". Cable: RG58U-52Ω Type. Freq: 26.8-27.4 Inclues coax cable with PL-259 plug & Allen keys.

$27



100-P

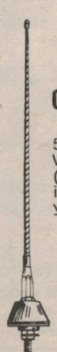
100-P Trunk Mount. Overall length: 26". Cable: RG58U-52Ω Type. Freq: 26.8-27.4 MHz Includes coax cable with P¾-259 plug & Allen keys.

$27

100-GM

100-GM Gutter Mount. Overall length: 43½". Cable: RG58U-52Ω Type. Freq: 26.8-27.4 MHz Includes coax cable with PL-259 plug & Allen keys.

$19.95



CBW1

5' Fibreglass Whit Antenna (Also available in red, blue, yellow, green)

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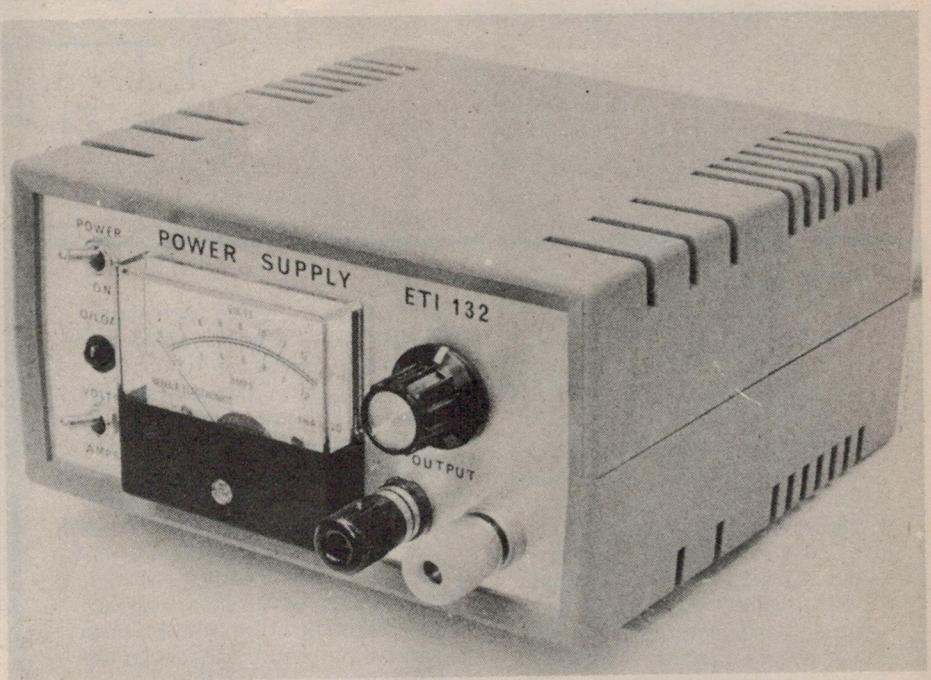
P&P + REG. $2.50

EXPERIMENTER'S POWER SUPPLY

This power supply is suitable for the experimenter. It has fully adjustable output voltage and current limiting. A single meter can be switched either to voltage or current while an LED will indicate an overload.

THIS ECONOMICAL POWER SUPPLY replaces the ETI 111 supply published some years ago. The 111 gave an output voltage variable between 1.5 and 15 V, this project gives the full range 0 to 15 V. In addition this supply features metering (or you can use the calibrated scale on the second version if you don't have a spare meter) to enable accurate setting of voltage or current.

The 132 is attractively housed in a plastic case and Scotchcal front panels are available to give the unit a professional look.



Construction

Commence by assembling the pc board with the aid of the component overlay diagram. The main filter capacitor C1 is normally a chassis-mounting type, but we mounted this satisfactorily by passing the lugs through the large holes in the pc board, bending them flush with the copper and soldering. Check the polarity of the capacitor before fitting, as it cannot be seen later. The transistor Q3 is fitted, along with its heatsink, with the two mounting screws. No insulation is used between the transistor and the heatsink but pass a small piece of tubing over the base and emitter leads where they go through the heatsink, to prevent shorting. If the meter is not required RV3, RV4 and R10 are not used.

The front and rear panels can now be drilled. Note that the mounting bracket of the transformer has to be cut back about 12 mm on one end to allow it to fit easily. If a scotchcal panel is used it

(Continued page 47)

SPECIFICATION ETI 132

Output Voltage	**0-15 V variable**
Output Current	**0-1 A**
Current Limit	**approx 1.2 A**
Load regulation	**35 mV 0 to 1 A load**
Line regulation	**20 mV 220 to 260 V input**

LED indication of current overload

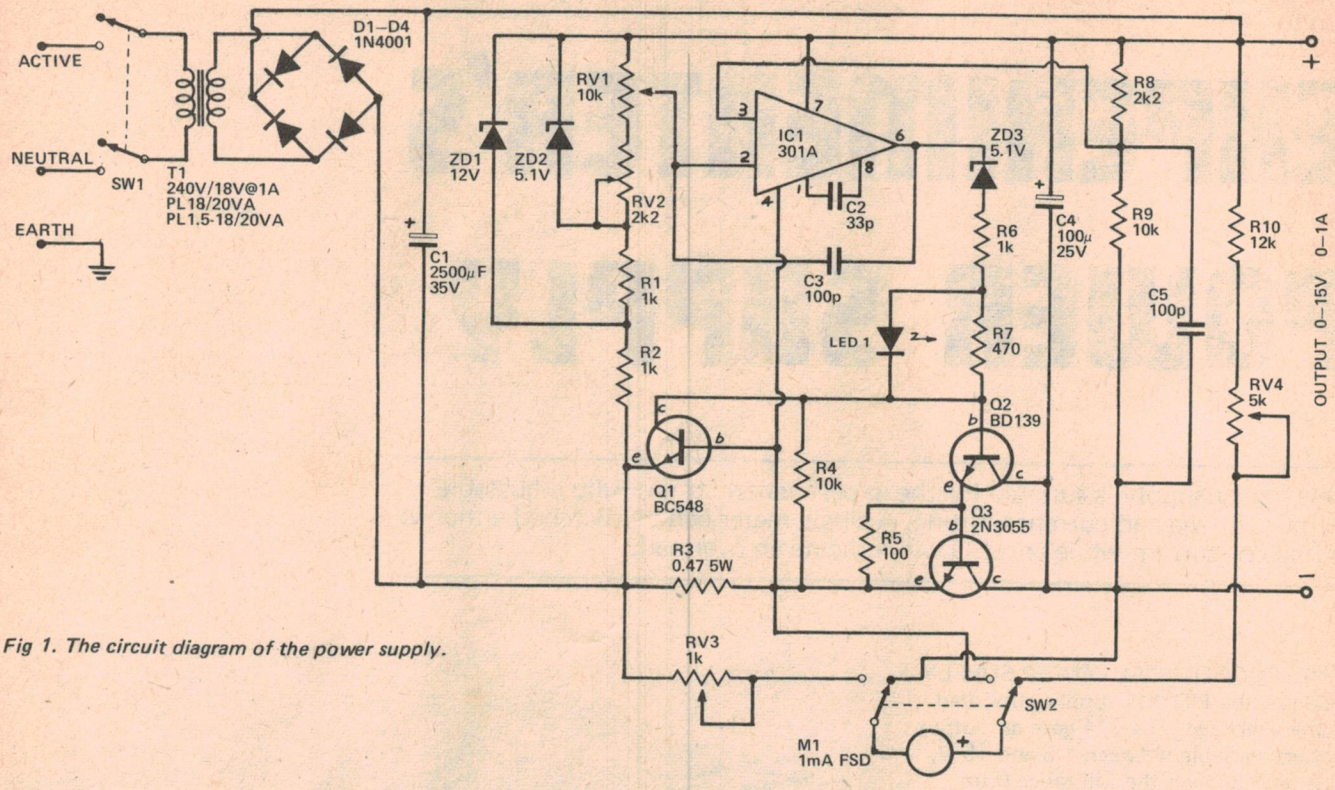


Fig 1. The circuit diagram of the power supply.

How It Works

The 240 V mains is reduced to 18 V in T1. This 18 V ac is then rectified by D1-D4 and filtered by C1 to give about 25 volts dc (on no load). The voltage reference for the supply is ZD2, which gives about 5 V dc. However, due to the large variation in voltage across C1 (caused by load changes) additional regulation is used, incorporating ZD1, and the two circuits give the stability required.

The regulator is a 'series-pass' type with the positive rail common and the negative rail variable. We have done it this way to achieve outputs down to 0 V. The comparator IC (LM301) cannot work with its input less than about 2 volts above the negative rail, but it can work with the inputs at the positive supply rail. However this will not work with all types of op amp – so do not substitute the 301 with a 741 or similar.

The output of ICI controls the output transistors, Q2 and Q3. A level-shifting zener ZD3 is used in the output of IC1 as its output cannot swing low enough. The output voltage is divided by R8 and R9 and is taken to IC1 which compares it to that set on RV1. IC1 then adjusts the drive to the output stage until the two voltages are the same. RV2 is used to compensate for variations in the voltage of ZD2.

In the event of an overload the voltage drop across R3 will forward-bias Q1, which will bypass current away from the output transistors. This causes the output voltage to fall, the comparator sees this error, and the output of IC1 goes to the positive supply rail (trying to compensate). Q1 however will continue to bypass any extra current, holding the output current constant at about 1.2 A. However, the additional current out of IC1 will forward bias LED 1 and it will indicate the overload.

With such high gain in the circuit additional frequency stability is needed and C3 and C5 provide this. For metering, we simply use a 1 mA movement meter and measure the voltage across the output (via R10 and RV4) and across R3 (current).

Setting Up

1. Without Meter – With this version we rely on the potentiometer to be linear. In practice it is not linear at the two ends of its travel. Calibration is done by adjusting the knob position and RV2.

Set the output to one volt and position the knob to read one volt. Now turn the knob to 15 V and adjust RV2 to give 15 V output. Recheck the 1 V setting and repeat the procedure, if necessary.

2. With Meter – Connect the output to an accurate voltmeter and turn the pot to maximum. Adjust RV2 to give 16 V. Adjust RV4 until the meter reads 16 V (with RV2 switched to volts). Now connect a load and an ammeter. Set 1A on the ammeter and then adjust RV3 until the power supply meter reads 1 A.

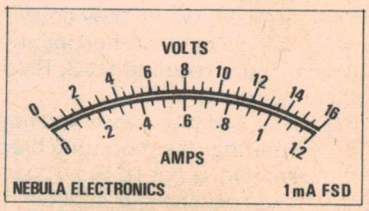


Fig 2. The meter scale used.

PARTS LIST ETI 132

Resistors

R1,2	1 k	½ W 5%
R3	0.47 Ω	5 W 5%
R4	10 k	½ W 5%
R5	100	" "
R6	1 k	" "
R7	470	" "
R8	2k2	" "
R9	10 k	" "
R10	12 k	" "

RV1	Potentiometer	10 k lin rotary
RV2	"	2k2 Trim
RV3	"	1 k "
RV4	"	5k "

Capacitors

C1	2500 µ electro type RG
C2	33 p ceramic
C3	100 p "
C4	100 µ 25 V electro
C5	100 p ceramic

Semiconductors

D1-D4	Diodes 1N4001
ZD1	Zener 5.1 V 400 mW
ZD2	Zener 12 V 400 mW
ZD3	Zener 5.1 V 400 mW
LED 1	LED with mounting clip

Q1	Transistor	BC548
Q2	"	BD139
Q3	"	2N3055
IC1	Integrated circuit	LM301

Miscellaneous

PCB ETI 132
Transformer 240 V – 18 V 2A
PI 18/20 VA or PL 1.5-18/20 VA
Case PC1
Power cord and clamp
Heat sink DSE H-3400
Two 2 pole 2 position 240 V Toggle switches
Two terminals
Meter 1 mA FSD scaled 0-16 V, 0-1.2 A
Knob

*If meter is not required delete RV3, RV4, R10, the meter and one switch

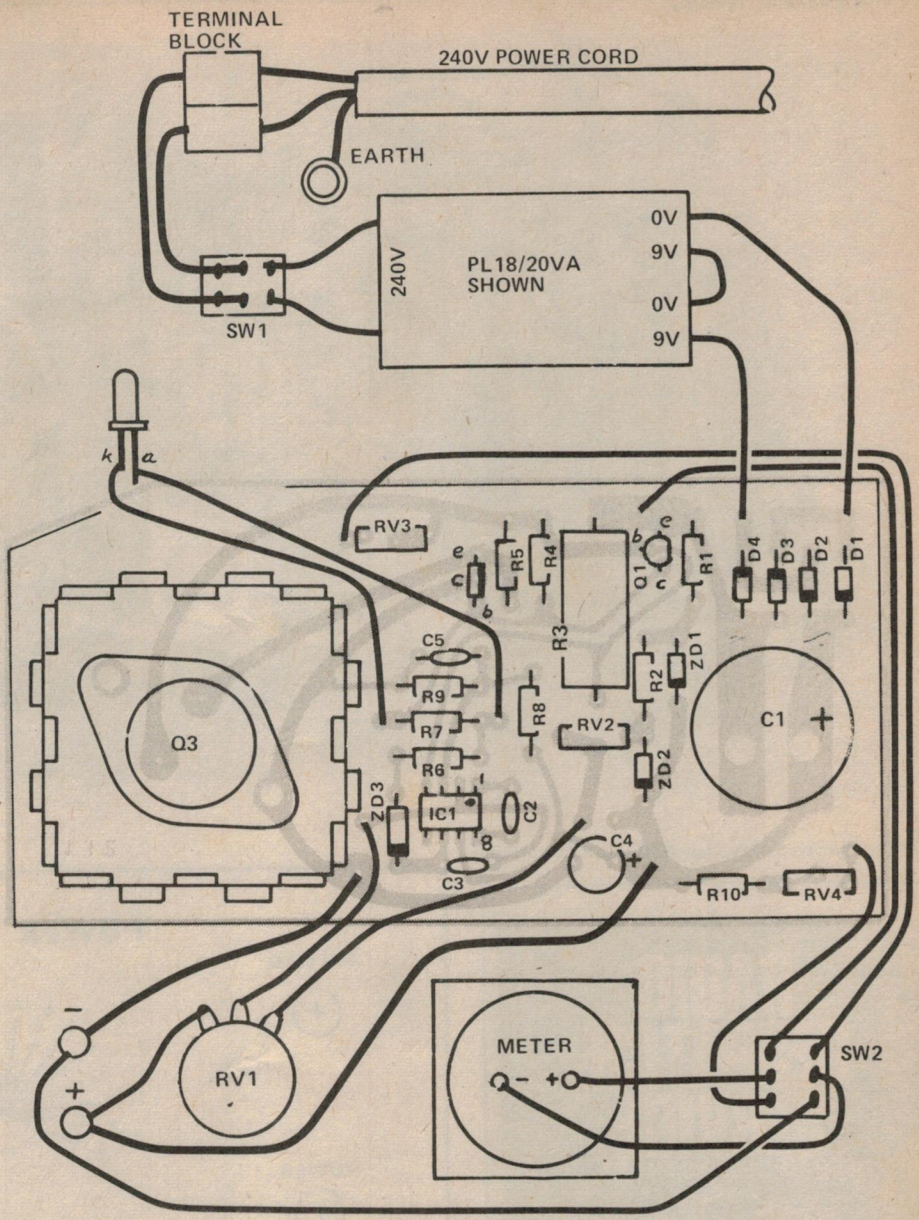
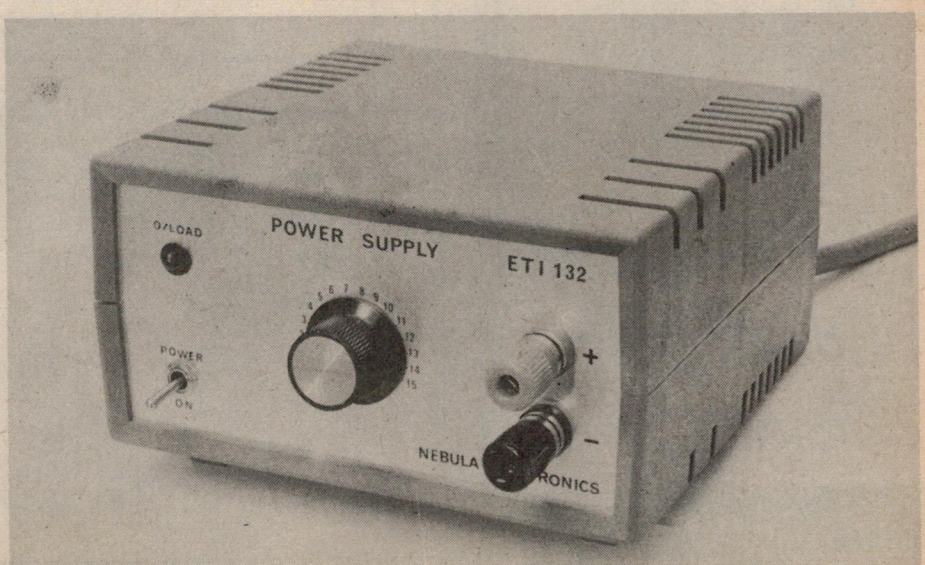


Fig 3. The component overlay and interconection diagram.



The photo on the right shows the second version of the power supply – where the voltage is set using a calibrated pot rather than a meter.

can be fitted before drilling and used as a template. Take care, however, not to scratch the panel.

Assemble the front and rear panels and wire the unit accordingly to Fig 3.

The wires to and from the power switch can pass the pc board via the chamfer on the lower left hand side. Other wires from the pc board to the front panel can be connected onto the copper side of the board.

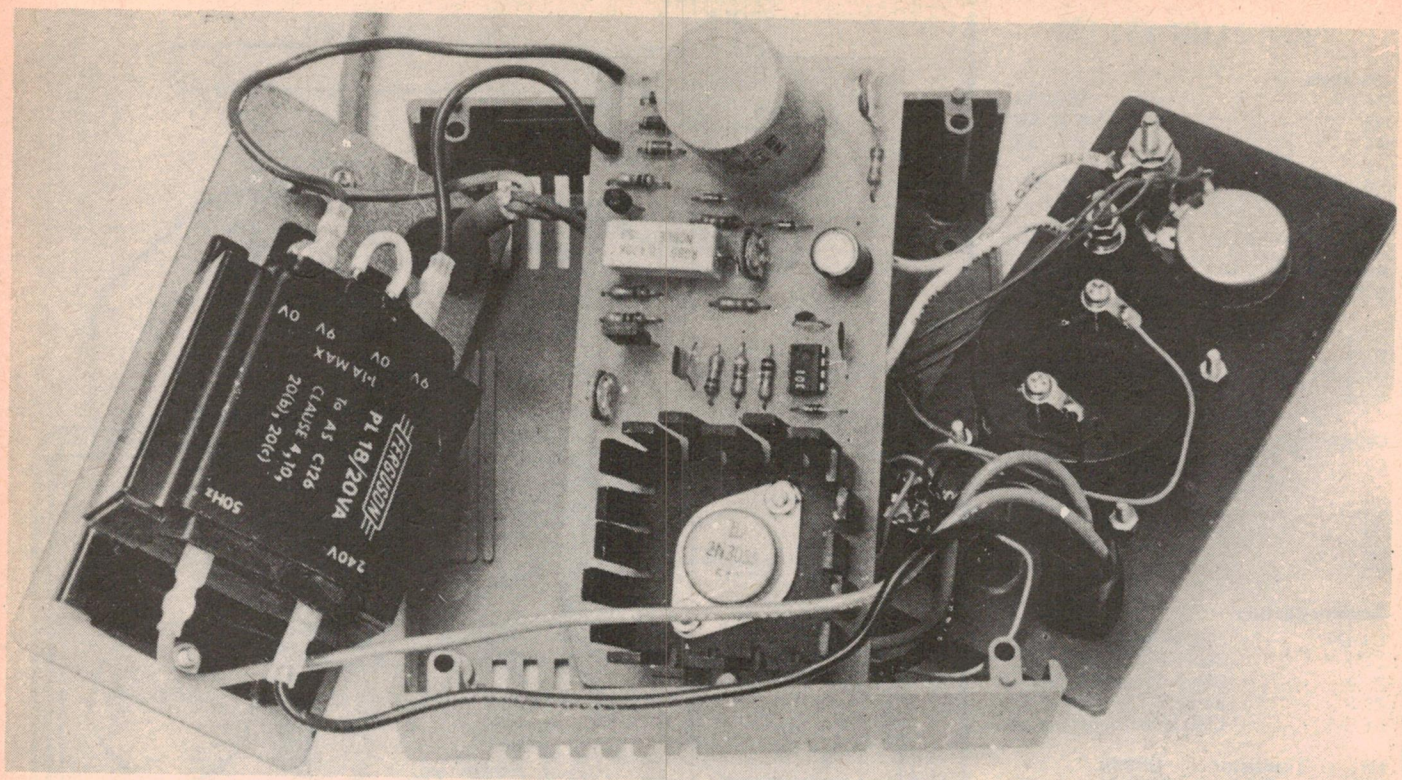
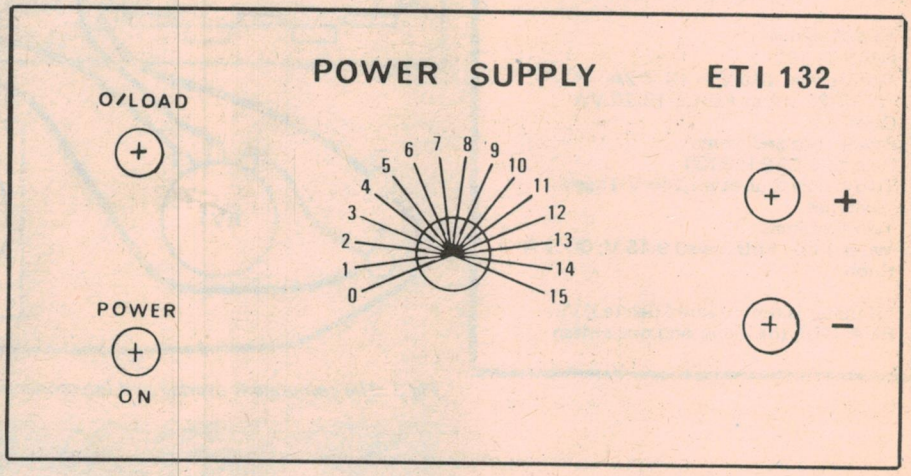
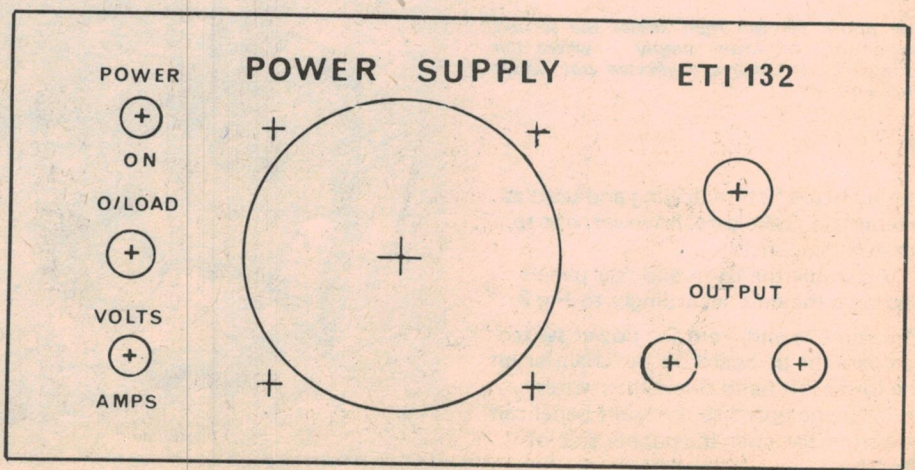


Fig 4. Front panel layouts. Full size 131 x 66 mm.





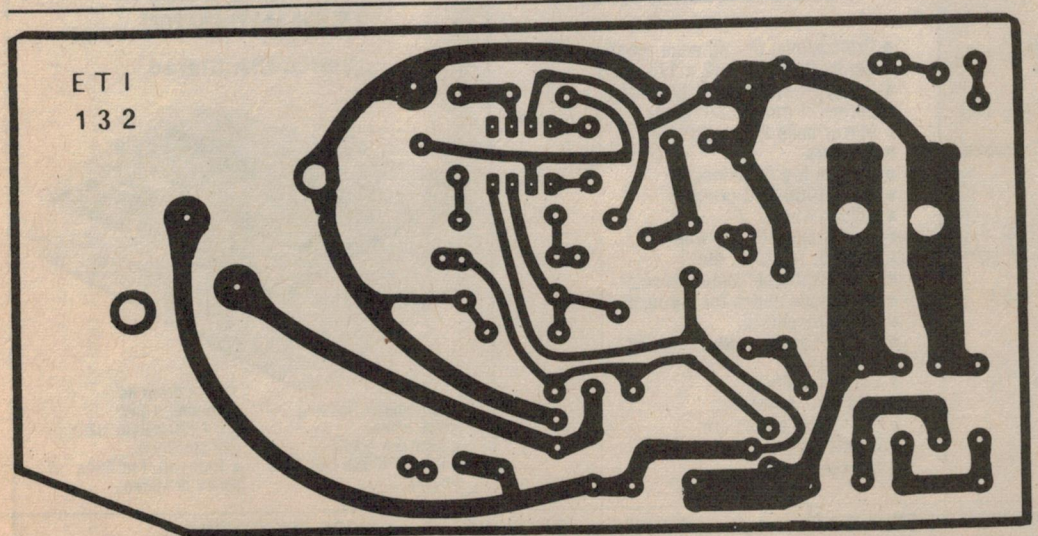


Fig 5. Printed circuit layout. *Full size 132 x 66 mm.*

SCOTCHCAL OFFER

Scotchcal panels ready to stick on are available from Electronics Today at $2.00 each. Send order together with a stamped addressed envelope - size at least 150x120 mm.

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Colour T.V. Theory (Hutson).....$10.00
Motorola Semi-Conductor Data Library (4 Vols).....$12.00
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Auto Engines and Electrical Systems$13.00
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Microprocessors (McGraw Hill).....$12.00

Transistor Circuit Design Tables.....$8.50
H/Book of Radio T.V. Industrial Transmitting Tube and Valve Equivalents.....$1.00
Transistor Equivalents and Substitutes $1.00
Solid State Communications.....$15.00
Semi-Conductor Handbook Part I.....$7.50
Designing with T.T.L. Integrated Circuits.....$20.00
Elements of Linear Microcircuits.....$6.50
Transistor and Diode Data H/Book (T.1.).....$5.00
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Fairchild Discrete Products (Transistors).....$5.00

DIGITRONICS

Many more not able to be listed here. Write for complete list.

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Vol.1 No.1 60c*

CB AUSTRALIA

How to get into CB Radio

- Understanding Transceivers
- Buying your first CB
- Installing a CB in your car

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CB AUSTRALIA

Vol.1 No1.

How to get into CB Radio

CB AUSTRALIA ***How to get into CB Radio***

Editorial:

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Publisher:

Collyn Rivers

This, the first issue of CB Australia, has been edited and produced by the staff of Electronics Today. It is presented free within the February 1977 issue of Electronics Today, and will also be available at the (recommended) price of 60 cents from all newsagents.

CB Australia is published by Modern Magazines (Holdings) Ltd, 15 Boundary Street, Rushcutters Bay, NSW 2021. It is printed by Wilke & Co, Browns Rd, Clayton, Victoria. Issues within Electronics Today are distributed by ACP, other issues by Gordon & Gotch.

COVER:

CB equipment CAN be licensed in Australia, but if you use it for non-specific 'citizens' communications you will be breaking the law . . . you become a radio pirate!

The Public Needs & Demands CB

In the January issue of ETI, the feature article on CB radio detailed the extraordinary development of CB in the USA, from its initiation in 1947 to the rapid expansion in recent years, the subsequent introduction of CB into other countries and recent developments in this area in Australia. The view of ETI is that there are no strong philosophical or technical arguments against the introduction of a citizen's band radio service. The current licensing situation in Australia allows certain organisations, individuals and companies to operate transceivers on the 27 MHz 'Industrial, Scientific and Medical' band and many sporting, boating and other groups, as well as some public service organisations, companies, etc, who have availed themselves of the service provided under the current radio regulations.

There are a considerable number however, who have availed themselves of CB in the breach — the pirates — who largely occupy the 26.96 MHz — 27.23 MHz amateur band. Pressure groups have formed and much talk in the media has brought the whole issue of CB radio to the 'public mind'.

Whether we should have CB in Australia, or not, should not really be a technical decision. Technical arguments and 'facts' have been advanced to support a variety of views on the subject — both pro and con. The decision should be based primarily on a value judgement of the (presumed) public needs and demand. It appears to be fairly clearly demonstrated that there is a reasonable public demand. It only remains then, to find the technical means and facilities (legislation) to meet that demand. Surely, this should not present too much difficulty?

As this issue, the first issue of CB Australia, goes to press, a report from the P&T Department is due to be discussed by the Cabinet of the Federal Government in Canberra. By the time you read this, CB could well be a fact in Australia.

If so, will Tammie Fraser be Australia's first 'First Mama' with a CB rig? (a la Mrs Ford).

CONTENTS

Transceiver Licensing Requirements

For amateurs holding the full ticket (AOCP) or the novice licence (NAOCP) any of the transceivers listed are suitable. Some of the multiband amateur transceivers available also cover 27 MHz. Examples are the later models of the Yaesu FT101 transceiver and the recently introduced NEC CQ-110E. As these are VFO controlled rigs, owners should be aware that some operators, particularly novices, have the fixed channel CB rigs and contacts are best sought on particular channels. Use the calling frequencies given elsewhere.

It should be noted that channel 23 is outside the Australian 27 MHz amateur allocation.

For those seeking a P & T licence you should enquire at your local P & T Regulatory and Licensing Section. Brochures and application forms for the different types of service can be obtained from them. To help you along the way the following forms are applicable:

RB 48 – Base stations (ship/shore safety service)

RB 191 – Hand-Phone Mobile radio service (application form RB 192)

RB 237 – Low-powered Mobiles (new application on RB 2A, additional mobiles on RB 10A

The general conditions for licensing transceivers for boating use and hand-held transceivers are detailed in a leaflet put out by the P&T (reproduced below).

WARNING

It is illegal to operate any of the radio transmitters discussed in this magazine without first obtaining a licence from the Postal and Telecommunications Department.

The P&T leaflet reproduced below sets out the regulations as they stand at the time of writing.

POSTAL AND TELECOMMUNICATIONS DEPARTMENT

INSHORE SAFETY SERVICES

The frequency of 27.88 MHz has been set aside for the use of Fishing Clubs, Yacht Clubs and other similar organisations which desire to establish their own ship/shore **safety service.** The conditons governing the licensing and operation of such services are as follows:

(a) Each base station shall be employed only for communication with vessels operating within inshore areas in the vicinity of the station.

(b) Messages shall be confined to matters relating to the safety of vessels in such inshore areas including search and rescue operations, position reports and weather and tide information.

(c) Only vessels operated by persons registered as members of affiliated clubs may be licensed to participate in the service and the application form must be endorsed by the Club Secretary accordingly.

(d) The Licensee shall keep a log showing the dates and times the station is manned and a record of the times of transmission and reception of all messages relating to distress and safety and the names of stations with which such messages are exchanged.

(e) Steps shall be taken to ensure that operation of the Base Station is undertaken only by personnel nominated by the Association and to prevent the handling of personal and other unauthorised messages.

(f) The maximum transmitter output power which will be authorised shall not exceed 3.5 watts Pm.

(g) The radio equipment to be used by the Base Station and the mobile stations shall meet the Department's licensing requirements in regard to power and design.

Application Forms: Base Station – Form RB 48
Mobile Stations – Form RB 192

DOMESTIC ACTIVITIES CHANNEL

Organisations desiring to exchange messages of a domestic nature between ship and shore e.g. messages relating to Club events, regattas and sporting activities, may apply to include this additional facility to their Inshore Safety Service Network. In the normal course where an application of this nature is approved, a frequency of 27.89 MHz, 27.90 MHz or 27.91 MHz will be assigned for domestic purposes.

HANDPHONE MOBILE RADIO SERVICES – Extract from Brochure RB 191

1. Licences in accordance with the provisions of the Wireless Telegraphy Act may be granted for the operation of low powered, short range mobile radiotelephone transmitting and receiving stations, intended for use while being carried by hand for such legitimate purposes as the Department considers warrant the grant of licences.
2. A service shall comprise at least two handphone units.
3. Licences will be granted only in respect of handphone units which are of a type approved by the Department. The maximum transmitter output power which will be authorised shall not exceed 700 milli-watts Pm.
4. The frequency assigned for this service is 27.24 MHz.
5. Application should be made on Form RB 192.

Regulatory and Licensing Section,
23 Berry Street (P.O. Box 970),
NORTH SYDNEY. 2060
Telephone: 929-8588

ADDRESSES OF P & T DEPARTMENT REGULATORY AND LICENSING SECTION OFFICES

Central Office
57 Bourke St, MELBOURNE 3000 VIC (63-0331)

NSW
23 Berry St. NORTH SYDNEY 2060, NSW (929-8588)
PO Box 970 NTH SYDNEY 2060)
Commonwealth Offices, Molesworth St, LISMORE 2480 (21-1223)
741 Hunter St, NEWCASTLE WEST 2302 (69-1400)
PO Box 2189 DANGAR 2309)
28 Bridge St, TAMWORTH 2340 (65-7969) (PO Box 338 TAMWORTH 2340)
D'Hudson House, 176 Bayliss St, WAGGA WAGGA 2650 (21-3844)
T & G Building, 304 Crown St, WOLLONGONG 2500 (2-6611) (PO Box 1109 WOLLONGONG 2500)

VICTORIA
2-10 Jolimont Terrace, EAST MELBOURNE 3002 (654-4400)
118 Armstrong St South, BALLARAT 3350 (32-1991)
Telephone Building, Williamson St, BENDIGO 3550 (43-1110) (PO Box 84 BENDIGO 3550)
Commonwealth Centre, 1 Raymond St, SALE 3850 (44-3511)

QUEENSLAND
Edmonstone Rd, NEWSTEAD 4006 (20-9406)
(PO Box 500 NEWSTEAD 4006)
Post Office, Bourbong St, BUNDABERG 4670 (71-2401)
State Gov. Insurance Building, Shields St and Esplanade, CAIRNS 4870
Post Office, East St, ROCKHAMPTON 4700 (2-0281)
42-50 Sturt St, TOWNSVILLE 4810 (71-5685)
(PO Box 522 TOWNSVILLE 4810)

SOUTH AUSTRALIA
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WESTERN AUSTRALIA
Cable House, 14-16 Victoria Avenue, PERTH 6000 (26-6356)

TASMANIA
Knopwood House, 38 Montpelier Retreat, BATTERY POINT 7000 (20-8111)

A.C.T.
7 Sargood St, O'CONNOR 2601 (49-8999) (PO Box 40 O'CONNOR 2601)

NORTHERN TERRITORY
AMP Building, 61 Smith St, DARWIN 5790 (81-9333)
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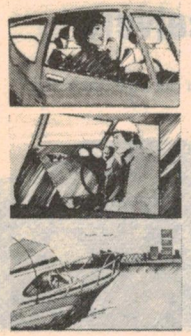

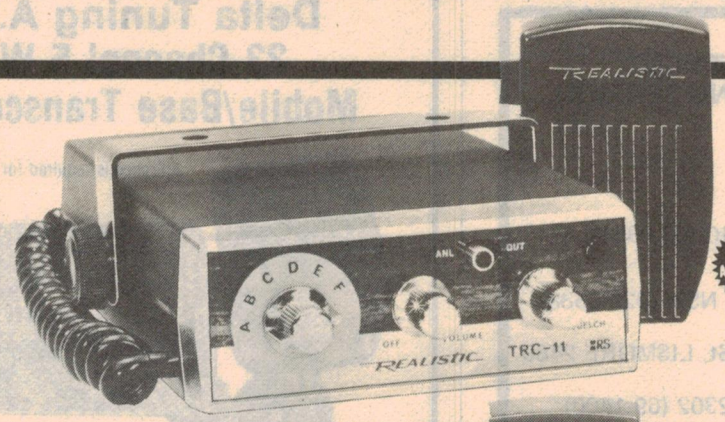

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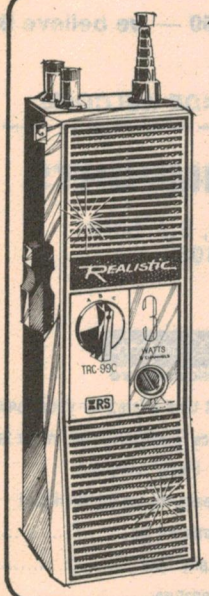

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3 channel Walkie Talkie 3 watts input

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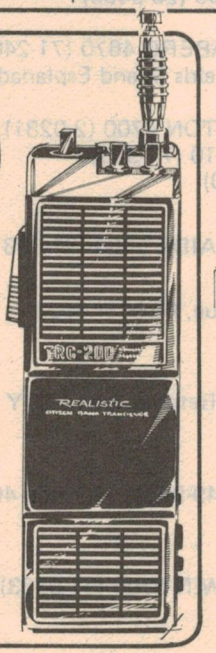
Realistic TRC.99C Sensitive receiver with Automatic noise limiter and gain control. Operate on batteries or use 12VDC from your car. Fitted with batteries and crystals for one channel.

USERS OF WALKIE TALKIE CB EQUIPMENT REQUIRE A PMG LICENCE

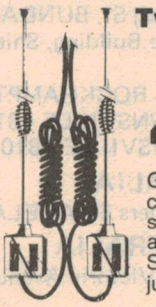


REALISTIC®

6 channel Walkie Talkie 5 watts input

89.95 ea 21.184

Realistic TRC.200. Loaded with power and features. The side panels couple your body to the antenna for extended range. Has fine tuning to pick up off frequency stations. Fitted with batteries and crystals for one channel.



Twin trucker. Dual C.B. antenna

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Gives superior coverage, stronger signal pattern, ahead and behind. Stainless steel adjustable tip rods.

Boot mount C.B. antenna

34.95 21.908

1.11m (44") Stainless steel whip. Mounts on boot without drilling.

there's a tandy electronics store near you!

Understanding CB Gear

There are two basic types of transmission employed in 27 MHz transceivers, and they are: Amplitude Modulation (AM) and Single Sideband (SSB).

Amplitude modulation is a system of transmission where the voice (or other audio signal) is impressed on a radio frequency 'carrier' by varying the amplitude of that carrier. The signal energy transmitted is contained in 'sidebands' immediately adjacent to the carrier, above and below it in frequency. The receiver picks up these sidebands and recovers the audio signal (voice or what-have-you).

In single sideband transmission the carrier and one of the sidebands is suppressed within the transmitter (or the transmitter section of the transceiver) and only one sideband is transmitted. This may be the 'upper sideband' (the one above the [suppressed] carrier) or the 'lower sideband' (the one below). Most SSB transceivers incorporate selectable upper or lower sideband reception and transmission. Single sideband is a much more efficient mode of transmission than AM and greater range is achievable using SSB. SSB is also much better than AM under weak signal conditions also.

Owing to the licensing and market situation here in Australia all the hand-held units available on the market (to date) are AM transceivers. The SSB transceivers available are principally mobiles or base/mobiles.

The frequency stability specification of transceivers is determined by the licensing conditions, which specify a stability of ± 50 parts per million (ppm) or ± 0.005%, which is the same thing. In terms of frequency, this is about ± 1.35 kHz at 27.000 MHz, which is not very much. Consequently, crystal control, either directly on the frequency or using a frequency synthesizer (explained shortly), is employed to meet the stability specification.

Crystals are made of natural or synthetically-grown quartz, a crystalline substance, which is cut in a particular way and ground to size according to the desired frequency, and then mounted in a suitable holder. When electrically excited the crystal behaves in a precisely predictable manner and can control the frequency of an oscillator to a very fine tolerance.

As explained above, transceivers may use crystal-control directly on the channel frequency and one pair of crystals is necessary for each channel to be used. Consequently, multi-channel units with crystals fitted for all channels are considerably more expensive than units having crystals for only one or two channels fitted.

Frequency Synthesisers

Some transceivers are advertised as having a 'frequency synthesizer'. This is a method of generating a number of channels from a single frequency source (a crystal) or from a combination of frequency sources (usually several crystals). Using this technique multi-channel transceivers can be made for a lower price than equivalent multi-channel units with one pair of crystals per channel.

There are a number of different methods of synthesizing the required frequencies, each has advantages and disadvantages. If you are technically inclined, it would be wise to study the different techniques employed before listening to salesmen who say things like '. . . it's got a synthesizer with PLL'). The subject is a little to lengthy to cover in sufficient detail here – some other time perhaps. Sorry to say that most sales staff (and advertising staff for that matter) don't really know much about what they're selling. There are notable exceptions, but if they blind you with science and technical jargon it's London to a brick they don't know what they're saying themselves. However, a synthesizer system incorporated into a transceiver can be generally considered an advantage as all channels are instantly provided whereas some multi-channel units that require crystals for each channel do not have all channels fitted. Check this when purchasing.

The general technical specification for most 27 MHz transceivers is remarkably similar, and not by accident. They have to meet a specification and there are only a limited number of ways of achieving this. You have to have a fair technical knowledge to understand the importance and relevance of the specification and I don't think it is necessary to go into the details here.

Power

The maximum transmitter power input (to the final stage of the transmitter), to meet the permissible maximum output power, is generally 1 W for hand-held units, although higher power units are available – and may be licensed (amateurs and pirates need not apply). These units employ AM transmission only, for the reasons previously outlined. Higher power units generally have a power input of either 3 W or 5 W. Battery drain for these units is consequently much higher and this should be considered when purchasing. Most units will accept Nicad batteries, which are rechargeable, and have provision for a charger to be connected.

AM mobiles or base station transceivers generally have a transmitter power input of 5 W, although at least one unit only has 3 W input and one other has 6.5 W input.

SSB mobiles and base station transceivers generally have a Peak Envelope Power (PEP) input of between 12 W and 25 W. The novice amateur licence permits 30 W PEP (SSB) (10 W AM) **output** from the transmitter, so most available CB transceivers will suit novices.

Power isn't everything, the difference between 12 W and 25 W is only a factor of two (2), or 3 dB, at the receiver, which is barely discernable to the ear. It does make a difference in effective range of communications – not necessarily a factor of two – depending on the circumstances. More power increases S-meter readings, which is good for the ego – if little else!

The Receiver Section

CB receivers are of the superhet type which, briefly explained, takes the incoming frequency, mixes it with another frequency (internally supplied) to produce a signal on a frequency which is the difference between the two – this is called the Intermediate Frequency or IF. The signal is then amplified at this (lower) frequency and detected. The IF usually includes some means of limiting the bandwidth over which it will accept signals on a particular channel – providing selectivity which improves the sensitivity of the receiver and rejects signals on adjacent frequencies. The receiver frequency tolerance specification is the same for the transmitter. However, some transceivers have provision to vary the receiver frequency slightly to accom-

modate signals that may be slightly off frequency. This is discussed later.

Most 27 MHz transceivers have a number of features and controls and these will be discussed before the market survey:

The Squelch Control

This control suppresses the received atmospheric and electrical noises when no signal is present, so that no noise is heard in the speaker although the receiver is switched on. Listening to noise continuously is fatiguing and a distraction if you are doing something else while monitoring a channel awaiting a call.

When the squelch is 'on' it does reduce the sensitivity of the receiver somewhat but in most situations this doesn't matter.

Most units have a variable squelch control so that the operator can set it at the most sensitive point, where the noise just disappears, or to a less sensitive point so that only a strong signal will 'open' the squelch. Some sets simply have a squelch switch. This is handy in situations where strong signals are available and the simplest possible operation is required.

Call Tone

This is a switch enabling you to attract the operator's attention at the other end. It simply transmits a tone, which is heard in the other receiver as the transmission opens the squelch.

ANL or Automatic Noise Limiter

This is part of the receiver circuitry and its purpose is to reduce the effect of impulse noise on received signals, particularly ignition noise from internal combustion engines. This sort of noise with its rapid and variable 'pop-pop-popping' can completely destroy a quite strong signal making it quite unintelligible.

The sort of ANL circuits used in hand-held transceivers and AM mobiles are only partially effective, but they are certainly better than not having anything. They do not 'remove' the noise interference, they work by limiting the amplitude of the pulses.

Noise Blanker

This is a more sophisticated system of reducing the effect of impulse interference. It works by effectively 'turning off' part of the receiver circuitry for the duration of each noise pulse. As the duration of these pulses is generally quite short the 'hole' in the signal goes unnoticed. As a consequence noise blankers are more effective than ANL circuits. They are principally used in SSB transceivers as ANL circuits are ineffective on SSB transmissions.

Noise blankers have the disadvantage that they can introduce distortion on a signal, particularly when noise pulses are repetitive at a rapid rate, but ANL circuits have the same drawback. The noise blanker circuitry can also degrade the ability of a receiver to reject strong signals on nearby channels as well as introducing distortion on very strong signals. Despite these drawbacks, they are enormously useful (provided they work as they are supposed to!).

Delta Tune

This control is fitted on some transceivers and enables the operator to vary the frequency of the receiver slightly up or down in frequency so that stations that may not be exactly on frequency (or exactly on the frequency channel of the receiver) may be received more clearly.

As all 27 MHz transceivers are fixed channel (with the exception of the rigs designed for the amateur market), the delta tune feature can be extremely handy. There is a tolerance on the transmitter frequency (maximum of 50 ppm or ± 0.005% in Australia) as all units cannot be expected to be exactly on the same frequency. Consequently, some may be towards the end of their tolerance range, and a receiver may be at the opposite end. If the selectivity of the receiver will not accommodate a signal this far away in frequency, reception is impaired. Hence the usefulness of the delta tune.

Some transceivers only provide a delta tune switch, moving the receiver frequency only a fixed amount. This is a simple way of implementing this function but a variable control is better, for obvious reasons.

The **amount** of frequency change effected by the delta tune control should be considered. A change of at least ± 1 kHz or ± 1.5 kHz is a desirable minimum.

Clarifier

This control is included on SSB transceivers and serves the same function as the delta tune control just described. However, it is of paramount importance on an SSB receiver as transmissions that are only as much as 100-200 Hz off frequency do not sound clear and this control enables the operator to adjust the receiver frequency to improve the clarity of reception – hence the name 'clarifier'.

For obvious reasons, it should be a fully variable control and all SSB transceivers incorporate a clarifier. However, you should be concerned how much variation the clarifier allows. To completely cover a tolerance range on transmissions of ± 50 ppm (± 0.005%), which is a variation of ± 1350 Hz at 27 MHz, the clarifier should provide a frequency variation of ± 1.5 kHz. However, that would cover most extremes likely to be encountered and most variation would probably be within ± (say) 600 Hz, i.e. about half the tolerance extreme. Thus, a transceiver with a clarifier variation of ± 600 Hz would be quite satisfactory.

Transceivers for the amateur market which incorporate 27 MHz have a clarifier variation of ± 5 kHz, at least, and some as much as ± 12 kHz. Some also have a 'Receiver Incremental Tuning' control (RIT) that can allow an offset between the transmit and receive frequencies as much as 20 kHz.

RF Meters and S-Meters

Many transceivers include a meter of some sort which is most often included to indicate the transmitter RF output and the received signal strength (hence 'signal meter' or S-meter').

When transmitting, the meter monitors RF output from the transmitter and is not really a measure of the actual power output. It is simply to indicate that the transmitter is functioning normally. Any gross change in the meter reading indicates a problem either in the transmitter, with the supply voltage, or with the antenna. It's a comfort more than a convenience.

On reception, the meter indicates the relative strength of the received signal. It is handy in a general sense and particularly in situations where a marginal signal is being received and the operator needs to move position to obtain a better signal to improve communications.

The meter may also be used to

indicate battery level – this function is often included where meters are included on hand-held transceivers.

Some transceivers include an 'SWR' (standing wave ratio) function for the meter which is primarily an indication of the impedance of the antenna-feedline system and is useful when tuning up an antenna and for checking that an antenna-feedline system is operational. Useful for quasi-technical types only.

Another function sometimes included for the meter is 'modulation monitor'. As you talk into the microphone (while transmitting) the meter leaps about the scale indicating that your dulcet buzz-saw voice is being impressed on the transmission. A portion of the meter scale may indicate when you are 'overmodulating' which causes distortion and increases the bandwidth of the transmission – which, for obvious reasons, is undesirable.

RF Gain Control

This control is found on some of the more sophisticated transceivers and is used to reduce the receiver sensitivity before the signal is detected. It is not really a 'volume' control. Strong signals can overload a receiver and become very distorted – to the point where they may be unintelligible, an undesirable situation obviously! Reducing the receiver sensitivity prior to detection (it usually varies the gain of the RF and or the IF amplifier stages in the receiver) overcomes this problem and clear communication becomes possible. It also assists in reducing the effect of strong signals in adjacent channels being detected – even though they are not on the frequency being received – as they are amplified by the RF amplifier of the receiver and acted on by the mixer and are subsequently passed through the receiver IF stages as unintelligible chatter (often referred to as 'monkey chatter'). This source of interference arises in the receiver and is not necessarily the fault of the transmitter in the nearby channel. An RF gain control can remove or reduce the effect of this problem.

It is a particularly useful control to have if you are an operator rather than a simple communicator . . . if you get my drift.

Mic Gain Control

This control is found almost exclusively on SSB transceivers. It allows the operator to adjust the level of amplification of the audio signal from the microphone to suit different conditions. The peak power of an SSB transmission depends to a large extent on the amplitude of the signal from the microphone and thus the peak power of an SSB transmitter may be adjusted with this control. However, its prime purpose is to adjust the sensitivity of the microphone, in effect.

In high (audio) noise level situations the mic gain is decreased and the operator speaks louder and closer to the mic. In quieter surroundings, the mic gain can be advanced and the operator can speak much further from the mic – comments from people in the background will also be heard, so watch it!

When signals are weak, turning up the mic gain and shouting only makes matters worse. This control is for more experienced operators.

Dual Conversion Receivers

The basic principle of the superhet has already been covered. However, the received signal does not necessarily have to be converted to a lower frequency only once. There are advantages in converting the received frequency several times to a much lower frequency.

A superhet receiver will be responsive to signals which are separated from the local oscillator (the internally generated conversion frequency) by an amount equal to the IF frequency. One of these will be the wanted signal, the other is called the 'image' frequency. Although the tuned circuits on the wanted signal frequency will reject the image frequency to some extent, strong signals may still be received. The higher the IF frequency, the further away is the image frequency and consequently the better the rejection of signals on the image frequency.

However, it is difficult to obtain adequate selectivity (by simple methods) at the frequencies necessary to reduce the image response of receivers on 27 MHz and so a second conversion is employed. The signal is first converted to a relatively high frequency (often around 9 MHz or 10 MHz) to reduce the image response and then to a second, much lower frequency (usually 455 kHz) where selectivity is easily obtained.

Dual conversion receivers are generally an advantage, but should not be regarded as a necessity. They are usually incorporated in the higher priced transceivers which have more features and are generally more sophisticated.

Other Facilities

Most transceivers, including hand-held units have jack sockets for external connection of an earphone or external speaker, an external microphone or an external antenna (on hand-held units). Also included may be a socket for connection to an external power supply (battery or mains type), battery charger (on hand-held units), etc.

Some transceivers make provision for using the unit as a low-power public address unit with an external loudspeaker. This is usually referred to as 'PA Facility'.

The use for which you are buying the transceiver will dictate whether you purchase a unit with only some or all of these features.

Some units incorporate lights to indicate when the transmitter is on, when the receiver is on (standby) and sometimes to indicate that a signal is being received. Some use a light to indicate when the transmitter is being modulated (i.e., when you are talking) rather than a light just to indicate when the transmitter is on. Some transceivers use these indicator lights in conjunction with a meter. Some hand-held transceivers incorporate a light which gives a 'low battery' warning.

A High/Low power switch is a feature of some hand-held transceivers and is useful in situations where only a limited range is required or where signals are strong enough on the lower power and a saving in battery drain is effected.

Some AM transceivers include what is termed 'range-boost' modulation circuitry. Simply explained, this means that more audio power (or voice power) is impressed on the carrier without causing a significant increase in distortion and without causing overmodulation. More audio is recovered from the signal by the distant receiver making the signal appear stronger than an equivalent transmission without range-boost modulation. Consequently, a pair of transceivers incorporating this feature should be able to communicate at greater distances than those without it.

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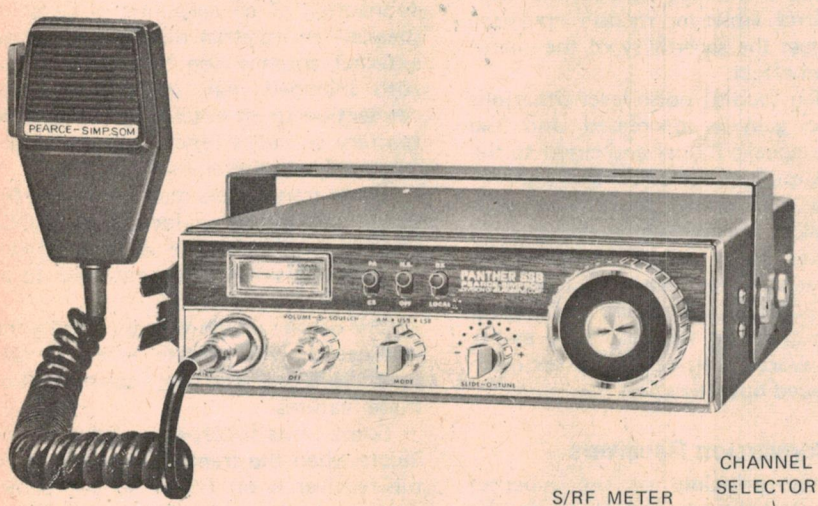

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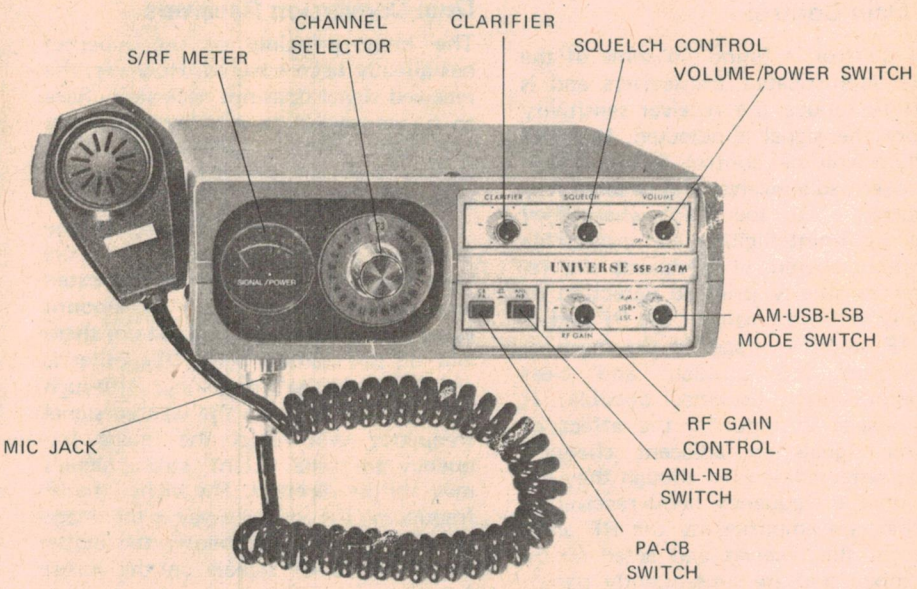

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CAVEAT EMPTOR* OR-A SHORT GUIDE TO BUYING 27 MHz TRANSEIVERS

When considering the purchase of a 27 MHz transceiver choice will be dictated largely by the following three criteria:

- the purpose for which the transceiver will be used
- the price (and/or available money – though time is here)
- the features (operational and/or technical)

The purpose for which the transceiver will be used, and the circumstances under which it will be used, will firstly determine what sort of transceiver you need to consider, viz: a hand-held transceiver, an AM mobile (or base) or an SSB/AM mobile (or base).

The price you pay will depend to some extent on the features included (or omitted in some cases). Performance enters into this and personal recommendation based on experience (i.e., hearsay) is as good a method as any until technical reviews are published. The usefulness of these depends a lot on the technical knowledge of the buyer though – maybe 'air testing' (a la roadtesting for cars) is a better method, along with some technical assessment. *Later, you impatient rabble!*

The features will certainly influence choice – probably a great deal in some cases. Where non-technical operators are to use the equipment – and this might include yourself (no insult, be honest), the fewer the knobs and gadgets to fiddle with, the better the results. With experienced communications operators or quasi-technical to technical types the controls and features necessary are largely a matter of the situation in which the transceiver will be used and/or a mixture of personal preference and prejudice.

Features such as PA Facility, external connection, etc, are usually icing on the cake – very thin, at that, in most circumstances. The number of these extras does not necessarily mean that you are getting a superior transceiver. As the basic requirements and specifications of most 27 MHz transceivers is much the same the manufacturer/salesman is forced to offer these extras as inducements to buy their particular product. They may quite possibly be useful but do not mistake them for prime requirements.

Hand-Held Transceivers

Hand-held transceivers hold their own (*sorry about that pun!*) where freedom of movement of the operator is important – hence the P & T term for these units, 'Hand-Phone Mobiles'. Alternatively, they are indispensable where no external power supply is available (be it battery or mains) or where it would be a liability – the internal batteries of hand-held units allow this independence. Many situations suggest themselves, more arise once you have obtained a pair of units. Sporting functions are obvious areas of usefulness, as are surveying, directing machinery operators, etc. They are also very useful in boats, particularly small, open runabouts.

Most hand-held transceivers have a power input of 1 W as these are licensable for a wide range of applications, whereas the higher power mobiles are licensable under somewhat more restriced circumstances (with the exception of amateurs of course). However, there are some lower-power units available (100 mW to 200 mW) which find application in situations where only limited range is required.

There are two primary channels available for hand-held units: 27.24 MHz, which is sort of a general purpose frequency and 27.88 MHz which is the boating safety channel. However, there are also three channels which may be allocated to boating/yachting clubs as 'domestic activities' channels. Consequently, for boating enthusiasts, a single channel set on 27.88 MHz is the minimum requirement with several of the other channels being a useful addition, depending on which is allocated to the club(s) or association(s) you belong to.

When buying a hand-held unit, make sure that the appropriate channel for your purpose is fitted. Generally, on multi-channel hand-held units only one of the prime channels will be fitted (either 27.24 MHz or 27.88 MHz), the others being an option and you will have to pay for the appropriate crystals to be fitted. They usually cost somewhere between $7 and $9 the pair (one transmit and one receive crystal).

It is wise to make sure that the set is type approved by the P & T Department before purchasing; call in or ring your local branch or inspector. Amateurs and pirates need not apply.

The range you require to cover is also a consideration when purchasing a hand-held transceiver. For strictly limited areas, such as within a building or around a small open area (i.e., several acres), the lower power units are generally the most economical in terms of purchase price and battery replacement cost (if dry cells are used) or battery drain (if Nicad batteries are used).

For widely varying conditions, or where long distances have to be spanned over open country or water, the higher power units (1 W) are best. The distance obtainable may be as much as 40-50 km over open water, about half that over open land. In urban and suburban areas, about 10 km range can be expected – more under favourable circumstances. Three watt and five watt hand-held transceivers can give coverage out to 100 km or so over open water, probably about half that over open land. In urban and suburban areas, 30-40 km coverage can be obtained, more of course under favourable circumstances.

The higher power 3 W and 5 W units are usually somewhat heavier than the 1 W or lower power types and fatigue is a consideration if prolonged usage is envisaged. Much practice at bending the elbow is an advantage, but not immediately prior to the unit!

As for features – well, separate and mic can be handy, especially where a unit has to be used in noise surroundings. Provision for an external antenna can also be very useful where access to a fixed antenna is possible. Provision for an external mic and speaker allows the unit to be converted to fixed or mobile operation if desired. The functions and usefulness of other

** Don't go into a cave unless it's empty!*

features has already been discussed.

A battery level indicator of some sort can be extremely useful on a hand-held transceiver, for obvious reasons. A meter (RF/S-Meter, etc) can also be useful but the small size necessitated does limit its usefulness somewhat. However, it does provide useful *proportional* or *relative* information as to signal strength and transmitter output, etc.

Mobiles/Base Stations

Most AM mobiles have a power input of 5 W, most SSB/AM mobiles having a PEP power input of between 12 W and 25 W on SSB and generally 5 W on AM.

According to brochure RB 237 from the P & T Department, low powered mobiles and their base stations may be allocated frequencies between 27.875 MHz and 27.915 MHz. The 23 channel units are popular amongst amateurs and pirates. The channels commonly used are according to the US 23 channel system and are listed separately.

If simplicity of operation is what you want, the fewer control knobs and switches the better – as I said previously. Particularly if the unit is installed in a car. The less attention to controls on a transceiver while driving, the fewer the distractions. For base station or home station amateur use a good operator can make use of a variety of controls to get the best communications under widely varying conditions. The sort of controls that may be incorporated, their functions and usefulness are discussed elsewhere. However, as a minimum, a squelch and volume controls, apart from the channel selection switch (some transceivers have push button channel selection – which has advantages of its own) are necessary. Some transceivers include an ANL in/out switch whereas others have the ANL circuitry permanently connected. Being able to switch the ANL out of circuit generally improves clarity when no impulse noise is present.

Controls such as Delta Tune and RF Gain have distinct advantages of their own which are discussed elsewhere and your requirement here is a matter of personal preference. These controls are very handy on base stations which have to handle communications with numerous mobiles under widely varying conditions.

SSB operation necessitates the use of the clarifier control, particularly where a number of stations are operating in a net. An awkwardly placed control knob is a liability. A well laid out front panel with all controls easily accessed by the operator, without other controls being disturbed, is a prime requirement for any transceiver. A mic gain control is a very useful inclusion on an SSB transceiver. Selectable upper and lower sideband is pretty well a necessity.

If you are technically inclined, examine and compare the technical specifications of several transceivers. Pay particular attention to receiver sensitivity and selectivity, the clarifier range on SSB receivers or the delta tune range on AM units. The squelch sensitivity and range is also a consideration.

With transmitter specifications pay attention to the power output if specified, the level of spurious emissions and with SSB rigs, the carrier and opposite sideband suppression. Battery drain on receive and transmit should also be considered.

Mechanical aspects of the transceiver should also be examined. Points such as ease of mounting, the size of the unit (particularly where space may be limited) and the actual layout of the front panel, are all considerations. Some transceivers suit left handed people better than right handed people – particularly when mounted in a car or boat. Some very small units are available and they generally have a minimum of controls on the front panel, as much due to lack of space as to avoiding compromising access to the controls.

Meters and their functions and usefulness have already been discussed elsewhere. However, they do have a role and this should be considered. What do you want a meter to tell you? Is it really useful to you or merely a prop? Having a comparative measure of received signal strength is very convenient in situations where signals are being received under widely varying conditions. An S-meter is invaluable in circumstances where it is required to optimise signal strength for best communications. Having a measure of the transmitter power output indicates proper or normal operation where some doubt may arise apart from indicating possible problems. The inclusion of an SWR measurement for a meter in a transceiver is perhaps a little superfluous – one has to know what it means and how to use it, but it does mean that a station can be largely self-contained, external indicators being unnecessary.

Illuminated meters and channel selection dials – particularly back-lighted dials – are an advantage. Some units change the meter illumination to indicate transmit or receive mode.

Other features and extras encountered may be the PA facility, external speaker and mic jacks etc. Comments mentioned previously about these inclusions still apply.

TRANSCEIVER SURVEY—

THERE ARE MORE THAN 50 different 27 MHz transceivers on the market in Australia at present. Nearly twenty are of the hand held variety, the others are meant for mobile or base station operation. That does not include combination units which incoporate AM broadcast radios, cassette players etc along with a 27 MHz transceiver. There are more than seven major suppliers/distributors and agents of these in most states apart from country areas. There are many other suppliers as well, but the majority of suppliers are based in NSW and Victoria where, presumably, the largest markets exist.

The transceivers available can be broken down into three broad categories: hand-held units, AM mobiles and SSB/AM mobiles. A few base station transceivers are available but as they may be used in either base or mobile roles I have not considered it as another category – especially as most mobiles are perfectly suitable as base stations also.

These three categories are broken down further into sub-categories in the market survey listings. The categories are as follows:

HAND HELD TRANSCEIVERS
- Below one watt
- One watt
- Three watt
- Five watt

AM MOBILES
- 1-11 Channels
- 23 Channels

SSB/AM MOBILES

With the hand-held transceivers, the breakdown is according to transmitter power input. The AM mobiles (nearly all 5 W units) are listed according to the number of channels available, the 23 channel units being in a separate category and listed according to price. The SSB/AM transceivers (all are 23 channel units) are also listed according to price.

An effort has been made to seek out information on as many units as possible. Units that cannot be licensed or that are otherwise unsuitable have not been included. However, omissions do not necessarily fall into this category.

Prices quoted are as recent as we could obtain but the kangaroo dollar is very likely to change things – naturally, upwards. Some prices may be low but all were current for December 76/January 77 to the best of our knowledge. Some units are on 'special' price from time to time and may be cheaper than quoted prices.

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Value	Voltage	1 off	25 up
1 µFd	6.3 Axial	15c	13c
2.2 µFd	25 p.c.b.	10c	8c
3.3 µFd	25 p.c.b.	10c	8c
4.7 µFd	10 p.c.b.	10c	8c
4.7 µFd	25 p.c.b.	10c	8c
22 µFd	10 p.c.b.	10c	8c
22 µFd	50 p.c.b.	17c	15c
25 µFd	16 p.c.b.	10c	8c
33 µFd	6.3 p.c.b.	11c	9c
33 µFd	16 p.c.b.	12c	10c
47 µFd	10 p.c.b.	14c	12c
47 µFd	25 p.c.b.	16c	14c
47 µFd	50 p.c.b.	17c	15c
100 µFd	10 p.c.b.	16c	13c
100 µFd	25 p.c.b.	18c	15c
220 µFd	6.3 Axial	20c	17c
220 µFd	16 p.c.b.	20c	17c
220 µFd	35 p.c.b.	26c	22c
470 µFd	6.3 Axial	25c	22c
470 µFd	25 p.c.b.	25c	22c
			10 up
1000 µFd	10 Axial	38c	35c
1000 µFd	16 p.c.b.	40c	36c
1000 µFd	25 p.c.b.	52c	47c
1000 µFd	35 p.c.b.	52c	47c
1000 µFd	50 p.c.b.	89c	80c
2200 µFd	50 upright	$1.80	$1.60
3300 µFd	50 upright	$2.05	$1.75
3300 µFd	75 upright	$2.70	$2.40

SEMI-CONDUCTORS:

T.T.L. Digital	1 off	10 up
7400	40c	35c
7402	40c	35c
7404	40c	35c
7408	40c	35c
7410	40c	35c
7420	40c	35c
7430	40c	35c
7447	$1.50	$1.40
7451	40c	35c
7454	40c	35c
7474	90c	85c
7490	80c	75c
7492	80c	75c
74107	$1.00	90c
ULM 3000S (Hall effect switch)	$6.00	$5.50

C/MOS

4001	40c	35c
4009	$1.25	$1.20
4013	$1.15	$1.10
4017	$2.50	$2.35
4018	$2.80	$2.70
4023	40c	35c
74C00	45c	40c

LINEAR

	1 off	10 up
LM301	70c	60c
LM307	70c	60c
LM304H	70c	60c
LM308	$2.30	$2.10
LM309K	$2.80	$2.60
LM319	$2.80	$2.60
LM324	$3.20	$3.00
LM339	$3.20	$3.00
LM377	$2.80	$2.50
LM382	$2.45	$2.30
LM3900	$1.50	$1.25
LM555	85c	75c
LM566	$4.50	$4.30
LM748	90c	80c
LM1458	$1.50	$1.30

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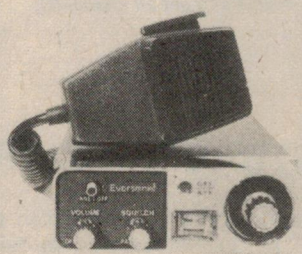

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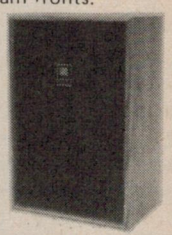

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CB NEWS

This new transceiver is shortly to be available from Tandy stores. It gives LED readout of the channel number and features a PLL synthesiser (you don't have to buy extra crystals to get all channels).

AUSTRALIAN GEAR

We have just received news of two new CB transceivers shortly to be two new CB transceivers shortly to be available in this country, the Cadet RA23 (AM) and the Cadet RS23 (SSB). These transceivers mark a major development in the local CB business . . . they will be made in Australia.

Ross Maclennan, director of Cadet Research Pty Ltd, believes his company is the first to produce gear of this kind in Australia. Ross told ETI he expected to have his first units ready by the beginning of March, but Cadet is a new operation and it is likely to be a couple of months before large quantities are available. We haven't seen either of the rigs yet but the design parameters shown below are guaranteed to blow your mind.

The RA23 receiver is based on a PLL synthesizer and features AGC and RF gain control, squelch, and digital channel readout. There is a switch to enable the operator to count up or down through the channels, or he can switch to automatic scan. In this mode the receivers clock through the channels until a station is found and that channel is then held until it goes silent. The 5 W transmitter section is to feature VOX operation – that is, the set will switch from receive to transmit automatically when the operator speaks into the microphone.

Cadet plan to make the RS23 in two versions, to deliver 15 W and 30 W PEP respectively. In addition to the RA23 features the SSB models will feature compression and clarifier facilities.

Cadet Research Pty Ltd can be contacted on (02) 560-3681.

NEW US FREQUENCIES

Here are the frequencies of the 40 CB channels now in use in the US:

Frequency	Channel	Frequency	Channel
26.965	1	27.215	21
26.975	2	27.225	22
26.985	3	27.235	23
27.005	4	27.245	24
27.015	5	27.255	25
27.025	6	27.265	26
27.035	7	27.275	27
27.055	8	27.285	28
27.065	9	27.295	29
27.075	10	27.305	30
27.085	11	27.315	31
27.105	12	27.325	32
27.115	13	27.335	33
27.125	14	27.345	34
27.135	15	27.355	35
27.155	16	27.365	36
27.165	17	27.375	37
27.175	18	27.385	38
27.185	19	27.395	39
27.205	20	27.405	40

This is how they come back. When ETI/CBA visited Peter Shalley he had a box full of hand-held units like this one in for service. And when he sends them out again they don't look much different ... what's the point in dressing them up when they have to go back to work in the bush. This particular batch are used by archeologists at the dig.

AM/FM/CB/CASSETTE

Strato Communications of Parramatta have just announced some interesting new CB transceivers coded Stratocom 606CB.

These are four-in-one combination units which mount in the dash where the car radio usually fits. The transceiver section is a 23 channel AM type and the FM radio and cassette player are stereophonic.

Strato also sell a power winch-up antenna which works on all three radio functions.

The Aircommand 40 channel CB Radio. With 17 more channels you can impress your friends with your friends.

To be an avid CB'er with a lot to say and nothing to say it on may, at times, become a little frustrating.

Consequently our new Aircommand 40-channel radio will be more than just worth looking at.

Not only are there the extra 17 channels, but every channel has an output capacity of four watts.

There's also an exclusive Channel 9 scanner. It "beeps" if there is an emergency call and you happen to be on another channel. It also has Delta Fine Tuning. Automatic Noice Limiting. Noise Blanking. P.A. capability, and a built-in 4" speaker (after all, you wouldn't expect anything less from the people who make famous Marantz stereo equipment).

In fact the new 40-channel radio probably is just about everything most CB'ers are looking for.

The only thing we can't supply is the extra friends.

To find out more about the Aircommand 40-channel CB simply fill in the coupon below.

Please send to: Aircommand 40-Channel CB,
c/- Auriema (A'sia) Pty. Ltd.
P.O. Box 604,
BROOKVALE, N.S.W. 2100.

Name . . . . . .

Address. . . . . .

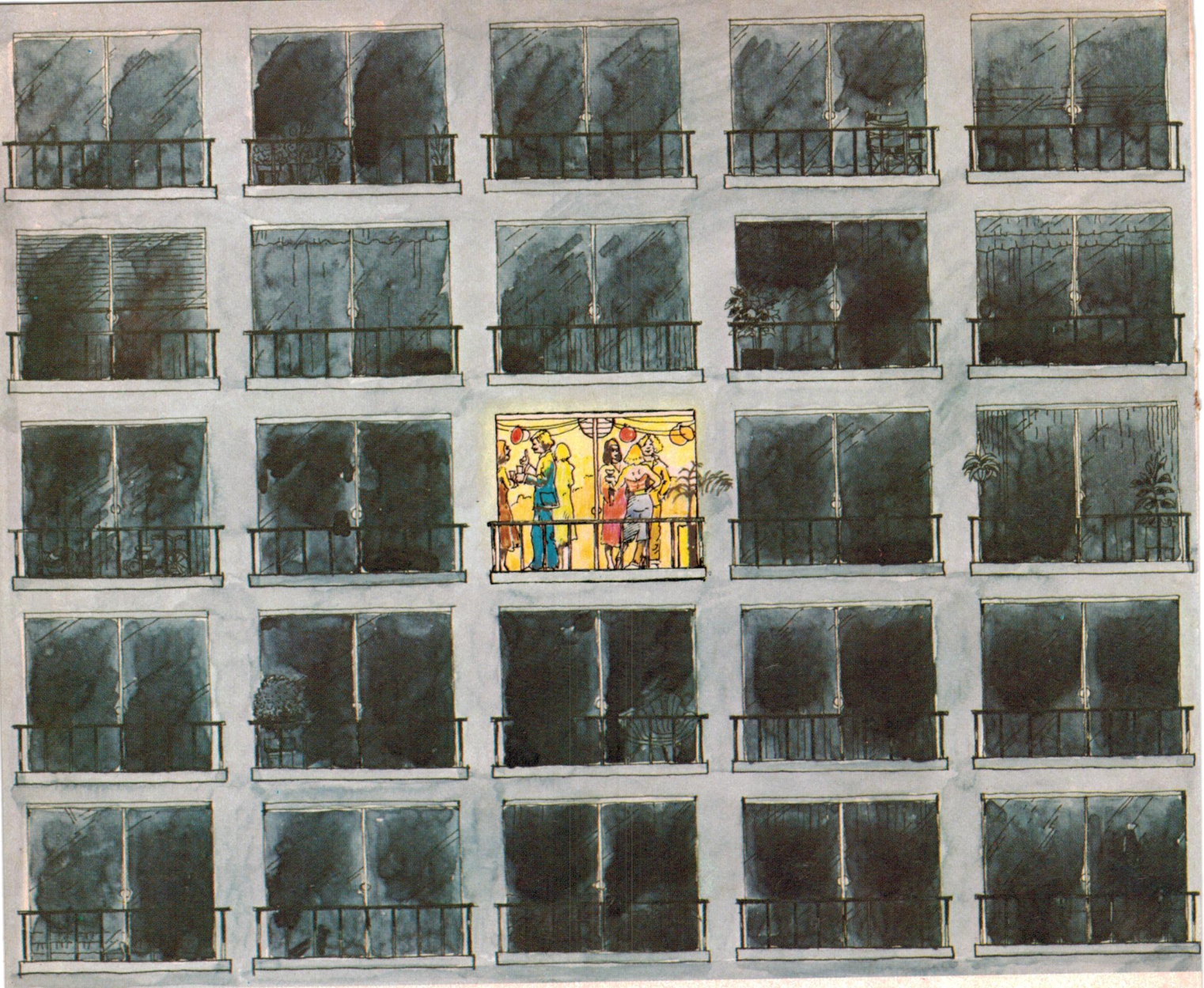
. . . . . .P/code . . . . . .

* Shipments available in May 1977

Aircommand

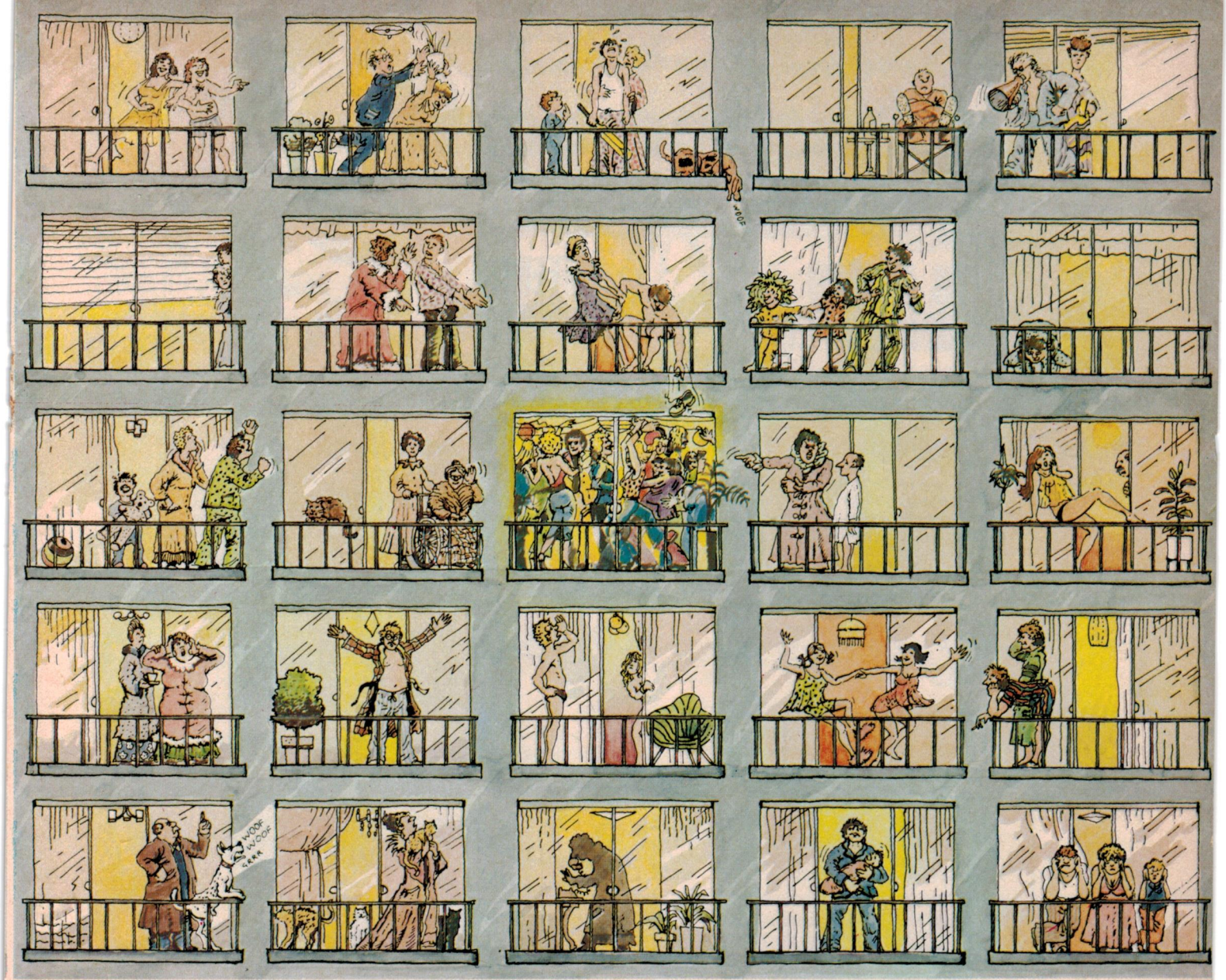
By SUPERSCOPE

MODEL CB-640 40 CHANNEL CB RADIO with LED Readouts, Channel 9 Scan and SWR Indicator



With La Scala speakers and a 35 watt amp you can entertain your friends

AUR20



or your neighbours.

At some stage in their hi-fi lives most buffs invariably want to upgrade their equipment for something with a little more oomph.

And this, we readily admit, more often than not turns into a rather expensive exercise.

So with that very thought in mind we suggest you have a very good listen to our Klipsch La Scala speakers.

They're designed to give you all the sound you need from a very minimum input. (In fact thirty-five watts per channel gives you more than enough oomph with La Scala's.) So saving you on having to spend up on highly expensive amplification equipment at the same time.

And the reason why La Scala's give such a big sound is simple.

They're horn loaded. And work on a similar principle to that of a megaphone or trumpet. So not only do you get a much purer sound. But the sound gets much louder, as well as getting louder faster.

La Scala's can also sustain a higher impulse such as a cymbal much longer, and yet still maintain an excellent quality at low levels.

As well as giving you low distortion over a wide range of frequencies.

In fact over thirty-five years of continual thinking and making have gone into the perfecting of La Scala's. And yet even with today's high technical standards few have been able to come near us in such terms of power excellence. So as you can see they're not an overnight pop phenomenon.

(We also think so much of our speakers that under normal usage we even give a lifetime guarantee.)

No doubt the only way to really appreciate just how good La Scala's are is to pay a visit to one of our dealers listed overleaf and purchase a pair.

If you're still not totally convinced once having installed them, we have one other sure fire way of testing them.

Turn up your amplifier and ask your neighbours.

Klipsch

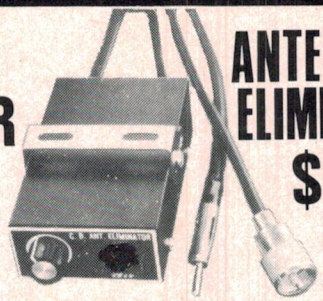
CB ACCESSORIES – DICK has the best!

NEW SHIPMENT JUST ARRIVED

CB RADIO CONVERTER

$33.00

Listen to the CB bands on your car radio. Recieves 26.535 – 27.610 MHz, converts it to normal AM band. Extremely simple installation; can also be used with other radios with correct fittings. 12V DC.
Cat D-3829 .. .. $33.00



ANTENNA ELIMINATOR

$27.00

Use your normal car radio antenna for CB transmission! No-one can tell you've got a CB with this fantastic eliminator. Very easy installation, SWR less than 1.5:1. Complete with instructions & fittings.
Cat D-5516 .. .. $27.00

INCREASE RECEIVER SENSITIVITY

$47.50

Increase the sensitivity of your rig! RF signaliser amplifies weak signals, lets you pick up stations like never before. Or lets you cut back very strong local stations and so avoid overload. Variable from –20dB to +15dB. **Cat D-3828 .. .. .. $47.50**

PLUGS

$1.45

PL259 Plug: as used in almost all CB radio equipment– sturdy construction; easy connection.
Cat P-2310 .. .. $1.45

$0.50

Reducing adaptor: necessary if you wish to use RG58U or sim. small dia. co-ax with the above plug. **Cat P-2360 .. .. . $0.50**

$1.20

Cable joiner: most cables are made with 2 x PL259 plugs. To join them, use one of these double ended joining sockets.
Cat P-2380 .. .. $1.20

$2.85

Right angle adaptor. PL259 plug one end, then right angle bend, then SO239 socket. Handy where space behind a rig is limited.
Cat P-2382 .. .. $2.85

$2.50

Dummy load: Perfect 52 ohm match, inside a PL259 plug. 5W rating, ideal for CB transceivers.
Cat D-7022 .. .. $2.50

BASES

$8.50

Gutta grippa: Sturdy, non corroding alloy. Very easy to fit.
Cat D-4625 .. $8.50

$8

Antenna Lead Assembly 3.5m co-ax, with fittings. For D-4615, 4623 & 4625. PL259 plug supplied.
Cat D-4624 .. .. .. $8.00

$11.50

Magnet Base: Incredibly powerful magnet; fits D-4615 antenna. Nylon gasket stops scratches.
Cat D-4623 .. .. .. $11.50

ALWAYS IN STOCK:
Tremendous range of all CB accessories, test gear, antennas, base supplies, plugs & sockets, cords, etc etc etc . . . and RIGS.

WHITE FLASH HELICAL ANTENNA

Brand new, exclusive to Dick Smith, the 'knight of the road' helical antenna. Includes base, lead-in, PL259 plug. **Value!**
Cat D-4076 .. $29.00

Mounts without holes! Boot or bonnet lip mounting with simple clamp attachment. Or you can mount it with a hole in the middle of the roof for optimum propagation characteristics. Base loaded, stainless steel whip. **Cat D-4450 .. .. $27.50**

Base loaded stainless steel whip includes PL259 plug in base to accept a number of bases (magnetic, etc) Rod adjusts for precise SWR. Cycolac base.
Cat D-4615 fits D-4623 base $11.50

Centre loaded mini-mobiles: Magnetic base (as illus) or gutter gripper. Just 550mm high, easily adjustable for SWR minimum. Easy to store to prevent vandalism (or pinching!) **Cat D-4412 (Mag base) $22.50**
Cat D-4411 (Gutter gripper) .. $19.50

AS USED BY HANS THOLSTRUP CROSSING BASS STRAIGHT.

DICK SMITH ELECTRONICS GROUP

HEAD OFFICE: Phone 439 5311 Telex AA20036 Cable 'Diksmit' Sydney
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Sydney — 125 York St, 29 1126 Bankstown — 361 Hume Hwy, 709 6600
INTERSTATE BRANCHES: QLD — 166 Logan Rd, Buranda 391 6233
VIC — 656 Bridge Rd, Richmond 42 1614

SEE THE OTHER DICK SMITH ADVERT FOR THE FULL LIST OF DEALERS

QUALITY CB GEAR

When you buy from VICOM you get only quality gear sold and serviced by the experts. All transceivers are given a thorough pre-delivery checkout supported by technical expertise and well equipped workshops. A wide range of spare parts is available and all new gear carries a 90 day warranty.

NEW

synthesised $279

PANTHER SSB DELUX TRANSCEIVER

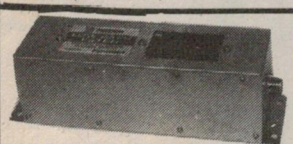
This superb rig is the ultimate in quality and sophistication! The Panther SSB is synthesised and requires no crystals - frequency stability is within 0.001%! There are 69 available modes: 23AM, 23LSB, 23USB at 5w am and 15w pep input. Controls include squelch, effective noise blanker and transceiver PA system switch. Front panel meter indicates modulation, "s" points or relative RF output. The rig comes complete with mic, mobile mounting brackets, dc cable and VICOM 90 day warranty. A real bargain!

BUILT-IN SWR BRIDGE!

$149

COUGAR 23 B AM DELUX TRANSCEIVER

Delux mobile 23 channel (synthesised) for the quality conscious Novice. The Cougar features built-in swr meter, noise blanker, delta tune, rf gain control, mic gain control, built-in modulation meter, separate PA switch. Circuitary consists of 1 IC, 20 transistors, 18 diodes. RECEIVER: dual conversion, sensitivity 0.5 uV for 10 dB S+N/N, selectivity 6 dB bandwidth 5 kHZ, PA audio power 5 watts. TRANSMITTER: 5w input, spurious harmonic suppression better than 55 dB. Comes complete with mic, mobile bracket, dc cable and manual.



TVI FILTER

$20

Superb quality low pass filter (32 MHz cutoff) for transmitters 1.8 to 30 MHz. Insertion loss under 0.5 dB, input/output impedance 50 ohms. Copper construction with SO 239 sockets. Will handle 200w pep (max). $20 + P&P
1KW pep model (0.3 dB insertion loss) $35 + P&P

GET THOSE EXTRA "S" POINTS!

QUALITY 27 MHz ANTENNA COUPLER

To match the transmitter final to the antenna line and ensure optimum power transfer. This quality coupler covers 27-30 HMz with an input impedance of 50 ohms unbalanced at 200w pep. Output impedance range 10 to 300 ohms unbalanced. Insertion loss better than 0.5 dB.

$59

POPULAR VC2 SWR/PWR METER

The popular VC2 covers 3-150 MHz with power measurement 12/120 watts. Will handle up to 1000w. 50 ohms impedance, twin meters. This quality tru-line instrument is ideal for the shack or for permanent mobile installation. $36 + P&P

$36

VICOM DEALERS WANTED

Vicom are seeking active Dealers to join our expanding Australian-wide CB retail outlets. We sell only quality gear and "get rich quick" outfits need not apply. Would-be Dealers should have technical facilities and personnel who are capable of handling and assisting with queries from our many customers. Written applications should be address to the attention of Managing Director.

A licence is required for all transmitting equipment.

ANTENNAS

BASE LOADED WHIP

Model M1 base loaded mobile whip, 40.5 inches long 50 omh impedance, vswr less than 1.5. Includes rood top mount, optional boot lid mount, spring and coax with PL259 plug. $27 + P&P

Model G2 as above with gutter clamp $29.90 + P&P

27 MHZ TRUCK ANTENNA

Twin centre loaded mirror mounted antennas especially designed for truck use. Comes complete with cables, plugs, connecting brackets, instructions. $42 plus P& P $3

$79

27 MHz Helical Ground plane

wound on light and strong fibreglass rod

CAR RADIO SPLITTER

Permits operation of your AM or AM/FM car radio from 27 HMz antenna. Can be used with any series fed (ungrounded) 27 HMz antenna. Finished with RG58/u and car radio high impedance lead, each 60 inches long. Excellent isolation between entertainment radio and 27 MHz transceiver. Includes adjustable 27 MHz match for optimising SWR. $31 + P&P $1.50.

PLUGS & SOCKETS (Minimum mail order $5)	
PL259 plug incl reducer	$1.30
PL259 without adapter	$1.30
SO239 chassis socket	$1.30
RCA/SO239 adapter	$2.20
Rt angle connector PL259/SO239	$2.20
"T" adapter SO239	$2.20
"T" adapter (2 female 1 male)	$2.50
Lighted 5w dummy load	$2.90
1½' coax jumper leads with PL259s	$2.30
3' coax jumper leads with PL256s	$2.50
3 & 4 pin transceiver mic plugs	$2.30
3 & 4 pin transceiver mic sockets	$2.30
Magnetic mix holder	.96
Lightning arrestor	$3.50
RG58AU 50 ohm coax 50c/m	
RG8 low loss coax $1.35/m	

13.8V DC POWER SUPPLY

This is a fully regulated supply with an output of 13.8 vdc at 3 amps (5A peak). Includes an on-off switch and neon indicator and comes complete with mains flex and 3 pin plug. Ideal as a bench supply or for powering transceivers.

$35 NEW

VICOM

DEALERS:

Perth:	Netronics, 388 Huntriss Ave., Woodlands Phone 46 3232
Adelaide:	Graham Stallard, 27 White Ave, Lockleys Phone 43 7981
Canberra:	Daicom Electronics, 29 Colbee Court Phillip Phone 82 3581
Brisbane:	Elite Electronics, 69 Wardell St Dorrington, Phone 38 4480

Head Office & mail orders . . .

139 Auburn Rd, Auburn, Vic. 3123 Ph: (03) 82-5398

Sydney

23 Whiting St, Artarmon, NSW 2064 Ph: (02) 439-1271

Prices include Sales Tax but exlude freight and insurance. For insurance allow $1 per $100, minimum $1. Freight sent Kwikasair (freight "collect") unless otherwise specified. Prices and specifications are subject to change without notice.

Where you can hear Klipsch La Scalas and entertain our neighbours.

N.S.W.

SYDNEY CITY:
Instrol Hi Fi. Kent Hi Fi.

EASTERN SUBURBS:
Woolloomooloo—Convoy Sound.

NORTH SHORE:
Crows Nest—Allied Hi Fi.
Brookvale—Riverina Hi Fi.

WESTERN SUBURBS:
Concord—Sonata Music.
Summer Hill—Fidela Sound.
Fairfield—Bing Lee Electronics.
Parramatta—Grammophone Shop.

SOUTH:
Miranda Fair—Miranda Hi Fi.

WOLLONGONG: Sonata Hi Fi.

NEWCASTLE: Ron Chapman Hi Fi.

TAREE: Godwins Hi Fi.

LISMORE: Lismore Hi Fi.

A.C.T.: Pacific Stereo.

VICTORIA

MELBOURNE CITY:
Allans Music. Southern Sound.
Instrol Hi Fi.

MELBOURNE SUBURBS:
Hawthorn—Tivoli Hi Fi.
Nth. Caulfield—Soundcraftsman.
Moorabbin—Southern Sound.
Mordialloc—Mordialloc Hi Fi.
Dandenong—G. W. Williams.
Warnambool—A. G. Smith.

QUEENSLAND:

BRISBANE CITY:
Reg Mills Stereo. Audio Labs.

BRISBANE SUBURBS:
Redcliffe—Hi Fi Sales (Q'ld.) Pty. Ltd.
Ipswich—Ipswich Hi Fi.

SOUTH AUSTRALIA

ADELAIDE CITY:
Allans Music.

ADELAIDE SUBURBS:
St. Peters—Sound Dynamics.
Blackwood—Blackwood Sound.
Mt. Gambier—Aslin Hi Fi.

TASMANIA

HOBART:
Quantum. Kingsway Audio.

WEST. AUSTRALIA

PERTH:
Alberts Hi Fi. Leslie Leonards.

Klipsch

Or write to Auriema (A/asia) Pty. Ltd.
P.O. Box 604, Brookvale, N.S.W. 2100
Telephone 939 1900

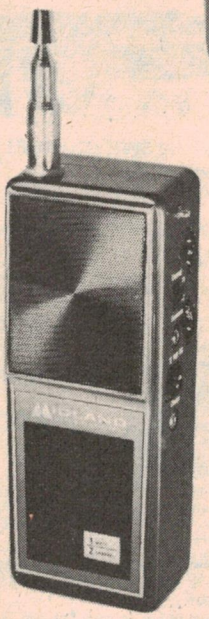
AUR 20

TRANSCEIVER SURVEY—
HAND-HELD UNITS

HAND-HELD TRANSCEIVERS below 1W

Model	Price	DC Input	Channels	Features
POCKETCOM (Distributed by Unitrex)	$ 60	100 mW	2	* Tone Call * Standby (low power, battery save) * Squelch * Low Battery Indicator
REALISTIC TRC-76 (Tandy)	$ 30	200 mW	3	* Separate Speaker & Mic * Battery Test Button * Squelch
SANYO TA-222A (Dick Smith, Radio Parts)	$ 40	300 mW	1	* Squelch * Battery Indicator

The REALISTIC TRC76



The MIDLAND 13-698

HAND-HELD TRANSCEIVERS 1W

Model	Price	DC Input	Channels	Features
CONTACT CT-10 (Peter Shalley)	$ 40	1 W	2	* Squelch * Simple Operation
MIDLAND 13-698 (Dick Smith)	$ 40	1 W	2	* Squelch * Call Tone
SANYO TA-303A (Radio Parts)	$ 50	1 W	2	* ANL * Squelch * Battery Indicator * Separate Speaker & Mic * External Mic Jack * External Antenna Jack
SHARP CBT-66 (Radio Parts)	?	1 W	2	* Squelch * ANL * External Antenna Jack * Battery Meter
SIDEBAND NC-310 (MS Components, Willis, ACE Radio, Ham Radio Suppliers)	$ 50	1 W	3	* Squelch * Battery Indicator * Call Tone * External Mic Jack * External Antenna Jack
TOKAI TC-1607 (Peter Shalley)	$100	1 W	3	* Squelch * Battery Indicator * Call Tone * External Mic Jack * External Antenna Jack
LAFAYETTE HA-310 (Lafayette Electronics)	$ 75	1 W	3	* Squelch * Battery Indicator

The REALISTIC TRC99C

HAND-HELD TRANSCEIVERS 3W

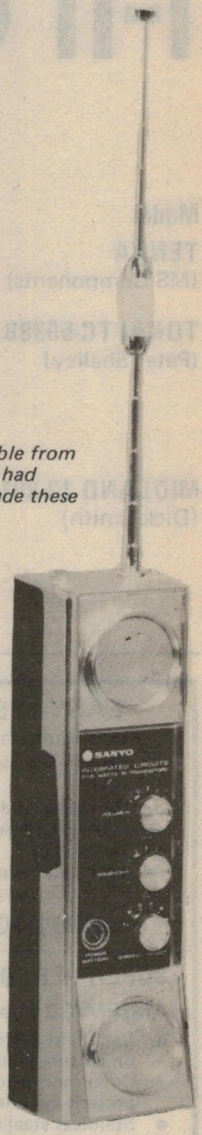
Model	Price	DC Input	Channels	Features
REALISTIC TRC-99C (Tandy)	$ 60	3 W	3	* ANL * Squelch * Battery Indicator/RF Meter * External Speaker & Mic Jacks * External Antenna Jack * Separate Speaker & Mic
DICK SMITH K25MR (Dick Smith)	$ 70	3 W	3	* Squelch * LED Battery Indicator

For details on the newest gear available (ie, transceivers not in the survey but which will be available at the time of publication) read the advertisments in this issue.

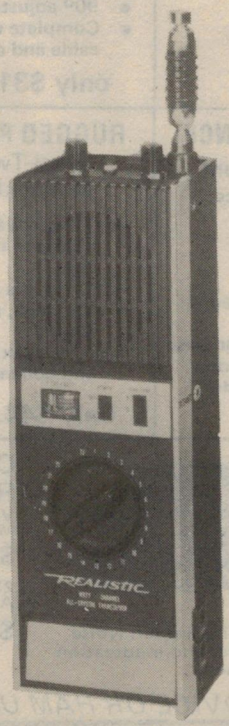
HANDIC transceivers are available from M&K (see suppliers list) but we had insufficient information to include these in the survey.

HAND-HELD TRANSCEIVERS 5W

Model	Price	Channels	Features
SANYO TA-395 (Dick Smith)	$ 85	6	* ANL * Squelch * Overmodulation Limiter * Separate Speaker & Mic * Battery Indicator/RF Meter * External Mic Jack * External Antenna Jack
REALISTIC TRC-200 (Tandy)	$ 90	6	* Squelch * Delta Tune Switch * High/Low Power Switch * Separate Speaker & Mic * External Mic Jack
TOKAI TC506 (Peter Shalley)	$120	6	* Tone Call * Squelch * Battery Indicator/RF Output/ S-meter * PA Facility * External Antenna Jack * High/Low Power Switch * External Mic Jack
DYNA-COM 12A	$140	12	* Squelch * Battery Indicator/RF Meter
REALISTIC TC-101B (Tandy)	$110	23	* ANL * Squelch * Delta Tune Switch * Battery Indicator/RF Meter/ S-Meter * High/Low Power Switch * External Mic Jack * External Antenna Jack * Separate Mic & Speaker



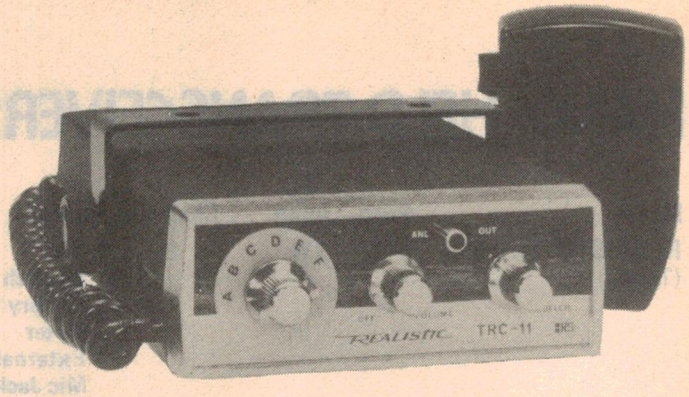
The SANYO TA-395



The REALISTIC TC-101B

TRANSCEIVER SURVEY—

AM MOBILES 1-11 CHANNEL



REALISTIC TRC-11 6 channel 5 watt.

Model	Price	Channels	Features
TENNA (MS Components)	$ 60	1	* Squelch * Small Size
TOKAI TC-5038B (Peter Shalley)	$100	3	* Squelch * Smallest Rig on the Market * Transmit/Receive Indicator Lights * ANL
MIDLAND 13-801 (Dick Smith)	$100	3	* Squelch * ANL * PA Facility * Transmit/Receive Indicator Lights

FINETONE TNC 5006.

For details on the newest gear available (ie, transceivers not in the survey but which will be available at the time of publication) read the advertisments in this issue.

MIDLAND 13-854

Model	Price	Channels	Features
REALISTIC TRC-11 (Tandy)	$ 90	6	* Squelch * ANL
SANYO TA-600 (Dick Smith)	$ 90	6	* Squelch * ANL
SIDEBAND MODEL 2 (MS Components)	$ 95	6	* Squelch * ANL * RF/S-Meter
FINETONE TNC 5006 (Mobile One)	$100	6	* Squelch * ANL * Overmodulation Limiter
PONY (Mobile One)	$100	6	* Squelch * ANL * S/RF-Meter
SHARP CBT-57 (Radio Parts)	?	6	* Push-Button Channel Selection * ANL * Squelch
MIDLAND 13-854 (Dick Smith)	$110	6	* Squelch * ANL * Transmit/Receive Indicator Lights * PA Facility
BELCOM (Peter Shalley)	$120	6	* Squelch
TOKAI TC-5041 (Peter Shalley)	$120	6	* Squelch * ANL
DICK SMITH B5060 (Dick Smith)	$140	6	*Base or Mobile Operation * 12 V dc/240 V ac Operation * Squelch * RF/S-Meter
MICRO 66 (Lafayette Electronics)	$140	6	* Squelch * "Range-Boost" Modulation * Pushbutton Channel Selection
WESTON (ACE Radio)	$135	11	* Squelch * ANL

TRANSCEIVER SURVEY—
AM MOBILES 23 CHANNELS

The ASAHI transceiver

Model	Price	DC Input	Features
UNIVERSE ST-12 (Aero Electronics)	$ 84	3 W	* ANL * Squelch * PA Facilities * RF/S-Meter
UNIVERSE CB-747 (Aero Electronics)	$ 94	5 W	* ANL * Squelch * Delta Tune * PA Facility * RF/S-Meter
ASAHI (Dick Smith)	$100	5 W	* Squelch * RF/S-Meter
TOKAI TC-5040 (Peter Shalley)	$100	5 W	* ANL * Frequency Synthesizer * RF/S-Meter * Small Size * ANL
UTAC TR-18 (Peter Shalley)	$100	5 W	* Squelch * ANL * Frequency Synthesizer * Dual Conversion Receiver * RF/S-Meter * PA Facilities * Transmit Indicator Light
REALISTIC TRC-68 (Tandy)	$110	5 W	* Squelch * ANL
MIDLAND 13-830 (Dick Smith)	$110	5 W	* ANL * Squelch * RF/S-Meter * PA Facility * Dual Conversion Receiver
CB 555 (Bail Electronic Services)	$120	5 W	* RF Gain Control * Noise Blanker and ANL * RF/S-Meter * Transmit Indicator Lights
FAIRMATE AC-500 (Mobile One)	$130	5 W	* Frequency Synthesizer * Squelch * ANL * Delta Tune Switch * Transmit/Receive Indicator Lights * Overmodulation Limiter * S/RF-Meter * PA Facility * Dual Conversion Receiver

The REALISTIC TRC-68 or Mini-23

The PONY CB78

The MIDLAND 13-830

The FAIRMATE AC500

PONY CB-78 $120 5 W
(Mobile One)

* Frequency Synthesizer
* Squelch
* Dual Conversion Receiver
* Overmodulation Limiter
* Transmit Indicator Light
* S/RF-Meter
* ANL

The REALISTIC TRC24C

EVERSONIC $120 5 W
(Mobile One)

* Frequency Synthesizer
* Dual Conversion Receiver
* Squelch
* ANL
* Local/distance (RX) Switch
* S/RF-Meter
* PA Facility
* Transmit Indicator Lamp

MICRO 723 $130 5 W
(Lafayette Electronics)

* Squelch
* "Range-Boost" Modulation
* Dual Conversion Receiver
* RF/S-Meter

The COUGAR 23B

REALISTIC TRC-24C $130 5 W
(Tandy)

* Squelch
* ANL and Noise Blanker
* Delta Tune Switch
* RF/S-Meter
* PA Facility
* Modulation Indicator Light
* Dual Conversion Receiver

SEAGULL CB-801 $130 5 W
(MS Components)

* ANL
* Squelch
* RF/S-Meter
* Transmit Indicator Light
* PA Facility

IBETA 23 $140 5 W
(CHS Taylor Warehouses)

* RF Gain Control
* Squelch
* Delta Tune Switch
* ANL
* RF/S-Meter
* PA Facility

The EVERSONIC transceiver

COUGAR 23B $150 5 W
(Vicom)

* Squelch
* Noise Blanker
* Frequency Synthesizer
* RF Gain Control
* Mic Gain Control
* SWR/RF/Modulation/S-Meter
* PA Facility
* Delta Tune Control

TRANSCEIVER SURVEY—
AM MOBILES 23 CHANNELS

KRACO $150 5 W
(Peter Shalley)
* Squelch
* ANL
* RF/S-Meter
* Dual Conversion Receiver
* PA Facility
* Map Light!!

The MIDLAND 13-882C

MIDLAND 13-882C $160 5 W
(Dick Smith)
* Squelch
* ANL
* Delta Tune Switch
* Antenna Warning Light (open/short circuit)
* RF/S-Meter
* Dual Conversion Meter
* PA Facility

CLARICON RAIDER 3 5 W
(Strato Communications)
* Squelch
* ANL
* RF/S-Meter
* PA Facility

SANYO TA-777 $166 5 W
(Dick Smith)
* Telephone-type Handset
* Sloping/easy access front panel design
* Squelch
* ANL
* Delta Tune Switch
* RF/S-Meter
* Hi-Lo Tone Switch
* Transmit/Receive Indicator illuminates meter
* PA Facility

The SANYO TA-777

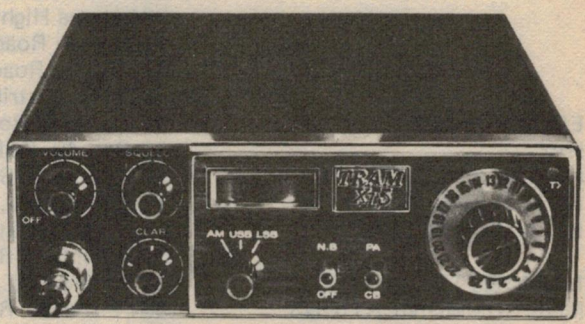
For details on the newest gear available (ie, transceivers not in the survey but which will be available at the time of publication) read the advertisments in this issue.

TRANSCEIVER SURVEY—
SSB/AM MOBILES

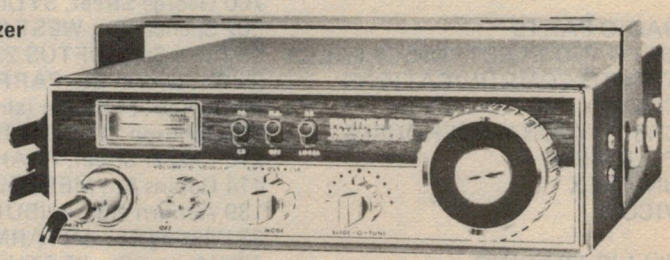
Model	Price	PEP Input	Features
GTX-3325 (Bail Electronic Services)	$220	15 W	* Noise Blanker * RF Gain Control * RF/S-Meter * Clarifier
CONTACT AC-123 (Peter Shalley)	$240	15 W	* Frequency Synthesizer * Dual Conversion Receiver * Clarifier ± 300 Hz * Squelch * Noise Limiter * RF/S-Meter * PA Facility
HY-RANGE V 674B	$250	12 W	* Noise Blanker & ANL * Squelch * Clarifier ± 800 Hz * PA Facility * S/RF Meter * RF Gain Control * Overmod. Limiter on AM
MIDLAND 13-892 (Dick Smith)	$280	15 W	* Clarifier * ANL * Squelch * RF/S-Meter * PA Facility
MIDLAND 13-893	$280	15 W	* RF Gain Control * Mic Gain Control * ANL * Dual Conversion Receiver * Clarifier ± 600 Hz * Squelch * RF/S-Meter * PA Facility
REALISTIC TRC-47 (Tandy)	$250	12 W (output)	* Squelch * RF Gain Control * Clarifier * Modulation Indicator Light * Frequency Synthesizer * Dual Conversion Receiver * ANL * Clarifier ± 600 Hz
PANTHER (Vicom)	$279	15 W	* Frequency Synthesizer * Squelch * RF Gain Control * Clarifier * Noise Blanker * PA Facility * RF/S-Meter
TELSAT SSB-75 (Lafayette Electronics)	$260	15 W	* Squelch * Clarifier * RF/S-Meter

The MIDLAND 13892

The REALISTIC TRC-47

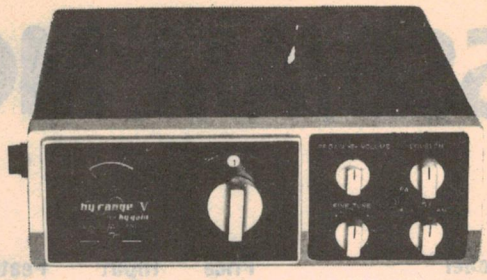


The TRAM XL5



The PANTHER transceiver

TOKAI TC-1000 (Peter Shalley)	**$290**	**25 W (6.5 W AM)**	*** Frequency Synthesizer** *** Squelch** *** Noise Blanker and ANL** *** RF/S-Meter** *** Clarifier ± 1.5 kHz** *** PA Facility**
CONTACT (BASE/MOBILE) (Peter Shalley)	**$300**	**25 W**	*** Squelch** *** RF Gain Control** *** Clarifier ± 300 Hz** *** Noise Blanker and ANL** *** RF/SWR/S-Meter** *** PA Facilities** *** 12 V dc/240 V ac Operation** *** Base/Mobile Transceiver**
TRAM XL5 (Mobile One)	**$312**	**12 W**	*** Noise Blanker & ANL** *** Squelch** *** Clarifier ± 1.2 kHz** *** PA Facility** *** S/RF-Meter** *** Transmit Indicator Light**



HY-RANGE Model 674B 23 channel transceiver.

For details on the newest gear available (ie, transceivers not in the survey but which will be available at the time of publication) read the advertisments in this issue.

SUPPLIERS

These are suppliers who stock stock CB equipment some of which is listed in the market survey, some supplied the information included in the listings. Some of the firms listed here have distributors in other areas and states, too numerous to mention. Omissions are not deliberate – but you should advertise your presence a little more boldly.

ACE RADIO	136 Victoria Rd, MARRICKVILLE 2004	NSW
AERO ELECTRONICS	Shop 13, 191 Ramsgate Road, RAMSGATE	NSW
AURIEMA	PO Box 604, BROOKVALE, 2100	NSW
BAIL ELECTRONIC SERVICES	60 Shannon St., BOX HILL NORTH 3129	VIC
BRIGHT STAR CRYSTALS	35 Eileen Rd., CLAYTON	VIC
COMMAND AUTO ACCESSORIES	11 Salisbury St., BOTANY 2019	NSW
DEITCH BROS.	70 Oxford St., SYDNEY 2010	NSW
DICK SMITH ELECTRONICS	162 Pacific Highway, GORE HILL	NSW
	125 York Street, SYDNEY 2000	NSW
	361 Hume Highway, BANKSTOWN	NSW
	166 Logan Road, Buranda, BRISBANE	QLD
	656 Bridge Road, RICHMOND	VIC
	and many distributors throughout Australia	
EDGE ELECTRIX	31 Burwood Road, BURWOOD 2134	NSW
HACO	PO Box 49, KENSINGTON, 2033	NSW
HAM RADIO SUPPLIERS	323 Elizabeth Street, MELBOURNE 3000	VIC
HOSE & EQUIPMENT	11 Salisbury St, BOTANY 2019	NSW
INTAG MARKETING	42 Grantham St., WEST BRUNSWICK	VIC
	34 Sydenham Rd., MARRICKVILLE	NSW
LAFAYETTE ELECTRONICS	94 St Kilda Rd., ST. KILDA 3182	VIC
M&K COMMUNICATIONS	561 Pittwater Rd., BROOKVALE 2100	NSW
MS COMPONENTS	164-166 Redfern Street, REDFERN	NSW
MOBILE ONE	227 Victoria Rd., MARRICKVILLE	NSW
NEW ELECTRONIC	57A The Centre, SEVEN HILLS 2147	NSW
PETER SHALLEY	554 Pacific Highway, KILLARA 2071	NSW
RADIO DESPATCH SERVICE	869 George Street, SYDNEY 2000	NSW
RADIO HOUSE PTY. LTD.	306-308 Pitt Street, SYDNEY 2000	NSW
	760 George Street, SYDNEY 2000	NSW
RADIO PARTS	562 Spencer St., WEST MELBOURNE 3003	VIC
SIDEBAND ELECTRONICS SALES	23 Kurri St., LOFTUS 2232	NSW
STRATO COMMUNICATIONS	25 Wentworth St., PARRAMATTA 2150	NSW
TANDY	throughout Australia (almost)	
CHS TAYLOR WAREHOUSES	169 Johnson St., COLLINGWOOD 3066	VIC
TELEVIEW	218 Chapel Street, PRAHAN 3181	VIC
UNITREX	414 Collins St., MELBOURNE 3000	VIC
VICOM	139 Auburn Rd., AUBURN 3123	VIC
	23 Whiting St., ARTARMON 2064	NSW
WILLIS TRADING	429 Murray St., PERTH 6000	WA
XENON WORLD IMPORTS	P.O. Box 33, WARRADALE 5046	SA

27 MHZ CHANNEL FREQUENCIES

Hand-Phone Frequencies:

27.240 MHz	(general)
27.880 MHz	(boating safety frequency)

Marine Safety and Domestic Frequencies:

27.880 MHz	(boating safety)
27.890 MHz	(boating
27.900 MHz	domestic activity
27.910 MHz	channels)

US 23 Channel System

Channel	Frequency (MHz)
1	26.965
2	26.975
3	26.985
4	27.005
5	27.015
6	27.025
7	27.035
8	27.055
9	27.065 •
10	27.075
11	27.085
12	27.105
13	27.115
14	27.125 ~
15	27.135
16	27.155
17	27.165
18	27.175
19	27.185
20	27.205
21	27.215 ~
22	27.225
23	27.255 *

•(emergency channel)
~(WIA broadcast frequency and amateur calling frequency)
~(amateur SSB calling frequency)
(This is outside the amateur band)*

Installing a Transceiver in your Car

Installing a transceiver in a car, boat or other vehicle requires some planning and forethought to obtain the best utilisation of the equipment (apart from the general technical requirements of an installation).

Location and Mounting

Choose a location for the transceiver which allows the operator easy access to all the controls — especially if he is also the driver of the vehicle. Most transceivers are supplied complete with suitable mounting brackets, a typical mounting being illustrated in Figure 1. The transceiver may be mounted to the underside of the instrument panel in a boat, or the dashboard of a truck or car, etc, by means of this bracket. As transceivers and their mounting arrangements differ, as do dashboards etc, how do you go about this depends on your individual situation. Figure 2 shows a transceiver mounted in a Range-Rover.

In some vehicles, particularly boats, it may be better to mount the transceiver on top of the instrument panel, the mounting bracket then going under the transceiver, opposite to the arrangement illustrated in Figure 1. Another alternative would be to mount the transceiver from the roof of the vehicle or boat cabin, out of the way of the driver's head.

An external speaker is an advantage in many situations, particularly where the internal transceiver 'speaker is partially obscured, most transceivers have the speaker mounted on the underside of the case. Car radio speaker installations are perfectly well adapted to this use and are an excellent solution. Many speakers made for vehicle installation are available and anything suitable may be used as an external speaker for your transceiver installation. Transceivers generally have an 'EXTERNAL SPEAKER' socket and a suitable plug can be obtained. Connections should be made in accordance with the manufacturer's recommendation, or you can get a qualified person to do it.

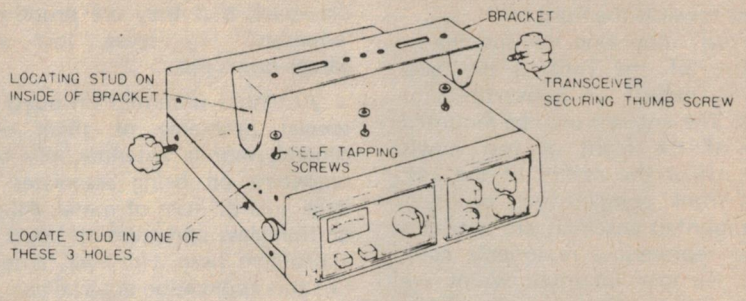


Fig. 1. Typical Transceiver Mounting.

DC Power Connections

As the majority of transceivers made are intended generally for mobile operation from a vehicle of some sort, they are made for operation from a nominal 12 V dc power source as this is what most vehicles use for their battery electrical systems (in practice the voltage will be more like 14 V). Most transceivers available can operate from either a negative earth or a positive earth electrical system, but it is wise to check this before installing (or buying!) your equipment. If the transceiver works only on positive earth systems, your vehicle should have a positive earth electrical system.

In general, transceivers are supplied with a power lead and connector. The leads are usually colour-coded: red for the positive lead and black for the negative lead.

Before making any power connections, determine whether the vehicle, boat, etc, has a negative or positive earth electrical system. Reverse connection could damage or destroy the transceiver circuitry.

The red power lead connects to the '+' (positive) side of the elctrical system and the black lead to the vehicle '—' (negative) side of the electrical system.

For **negative** earth systems, connect the **red** lead to the accessory terminal on the ignition switch, the voltage regulator side of the ammeter, or the accessory side of the fuse block. The **black** lead should be connected to the chassis of the vehicle in the case of cars, trucks etc, or any point which is connected to the **negative** side of the vehicle or boat electrical system (earth).

For **positive** earth systems, connect the **black** lead to the accessory terminal on the ignition switch, the voltage regulator side of the ammeter, or the accessory side of the fuse block. The **red** lead should be connected to the chassis of the vehicle in the case of cars, trucks etc, or any point which is connected to **positive** side of the vehicle or boat electrical system (earth).

An 'in-line' fuse may be included in the power lead of the transceiver or you may delete this and use the vehicle fusing system. In either case a fuse of a suitable rating should be used; generally a 2 A or 3 A fuse is suitable for most 5 W, 27 MHz transceivers.

The Antenna Installation

Whatever antenna is chosen, it should be installed, so far as is possible under the circumstances, as high as possible on the vehicle or boat, and as centrally as possible. This ensures that the

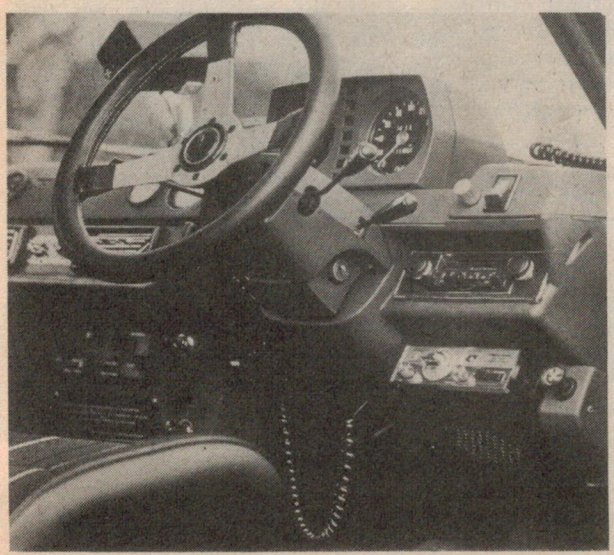


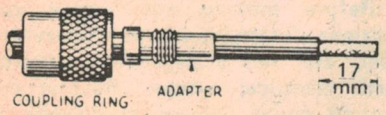
Fig. 2. This photo shows a 23-channel transceiver mounted in a Range-Rover. Note the loudspeaker is mounted on the bottom of the case which is OK when the unit is mounted under the dash but would be unsatisfactory if it had been mounted in the dash itself (like the radio in this picture). In this case an extension loudspeaker should be used.

Installing a Transceiver in your Car

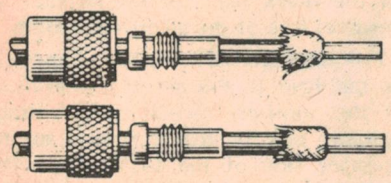
antenna radiates well in most (or all) directions towards the horizon.

On a car, mounting the antenna in the centre of the roof is the best position – except on convertibles or soft-tops. The antenna may be mounted on one of the front or rear cowls however, or at the centre of the car, over the trunk compartment or boot. Gutter mounted antennas are available also, and represent a reasonable compromise. Bumper mounted whips are generally not as good as any of the others, although some special types may be obtained which overcome the disadvantages of this method of mounting but they are generally quite large compared to other types available.

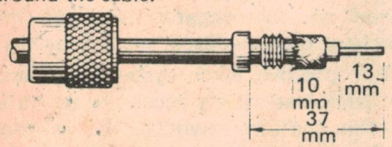
Fig. 3. Assembling a PL-259 plug to coax cable.



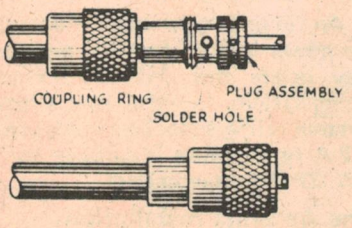
(a) Cut end of cable evenly. Remove vinyl jacket for 17 mm back from end . . . don't nick the braid. Slide coupling ring and adapter on cable.



(b) Fan out the braid slightly and fold it back over the cable. Then compress the braid around the cable.



(c) position the adaptor shoulder about 37 mm back from the end of the cable. Press the braid down over the body of the adapter to the dimension shown and trim it. Next, bare the centre conductor at the end by removing 13 mm of the insulation . . . don't nick the centre conductor. Tin the exposed portion of the centre conductor.



(d) Screw the plug assembly on the cable and adapter. Solder the centre conductor into the centre pin of the plug assembly. Solder the braid to the plug assembly through the solder holes. Use a hot iron with good heat capacity. Finally, screw the coupling ring onto the plug assembly.

Roof mounted antennas do have the drawback that they are prone to being 'wiped-off' by trees, low awnings, garage doors etc.

Antennas mounted on boats present special problems of their own. In general, mobile antennas rely for their operation on being associated with a large area or mass of metal. All-wooden or fibreglass construction boats present a problem here. However, antennas to suit this application are available.

Antenna manufacturers generally provide mounting instructions with their antennas and these should be followed when installing the antenna. A survey on antennas for 27 MHz installations is scheduled for the near future.

Care should be taken when mounting the antenna that it is not close to any large structure on the boat or vehicle – particularly if it is of metal. Cowl mounted antennas should be mounted somewhat away from the passenger compartment on a car so as not to upset the antenna performance – it is influenced, but this can be minimised by installing the antenna as just mentioned. A good bond to the metal chassis of the vehicle is required as part of the antenna feedline connection – depending on the particular construction of the antenna. Follow the manufacturer's instructions.

The Antenna Feedline

A coaxial cable is used to connect the antenna to the transceiver. This consists of a flexible inner conductor surrounded by plastic insulation which is in turn covered by a woven wire braid. This is then covered by a protective plastic sheath. The most common type used is called **RG58** and is about 6-7mm overall diameter. Antenna manufacturers generally provide either some sort of connecting terminals for the feedline, or a socket.

The most commonly used socket on antennas and transceivers is the type **SO-239** coax socket. This accepts a type **PL-259** plug which is assembled on to the feedline. Apart from basic plug and socket, a wide range of adaptors and other connectors are available; such as female-female connectors (back-to-back sockets) for joining lengths of cable with PL-259 connectors on the end, right angle connectors that have a plug on one end and a socket on the other, tee-connectors, etc.

The common PL-259 plug requires soldering but solderless types are available and are equally as good if properly assembled. Step by step instructions for installing the common PL-259 plug are given in Figure 3.

The length of feedline between the transceiver and the antenna should be as short as practicable, but route it so that it is not likely to be trodden on or damaged in any other way. Sharp bends should be avoided and the cable protected from chafing or any other sort of wear. Connections and connectors should be protected to prevent the ingress of moisture, particularly at the feedline connection to the antenna. Wrapping joints and connectors in insulation tape should only be regarded as a temporary measure. Sealing compounds which remain pliable, such as Silastic or Selley's sealing compound, offer excellent protection and can be moulded to suit the application.

Vehicle Noise Suppression

In most mobile installations the engine electrical and ignition systems cause electrical noise which is picked up by the transceiver installation and this can cause quite severe interference to reception. Ignition noise is particularly a problem.

Before beginning any special noise suppression steps, you should first ensure that the vehicle is well tuned. Clean and tighten all electrical connections, including the alternator or generator, battery, regulator and ignition coil connections. Clean all spark plug insulators and clean and adjust the gaps according to the engine manufacturer's recommendations. Replace plugs if necessary and the points as well. Check and clean the alternator rings or generator brushes and commutator. Have the engine retuned and do this at regular intervals or according to the manufacturer's recommendations. Solder any crimped connections to the spark plugs, coil or distributor.

Several sources of noise are usually present in any vehicle, the strongest source usually covering the others. In order to find and eliminate the maximum number of noise sources you will have to begin with the strongest and work back to the weakest. To be sure the noise you hear comes from your engine and not elsewhere, take the vehicle to a relatively quiet location (if possible – or do it at dead of night or other relatively 'quiet' time). Avoid places that may produce industrial noise or interference, and other vehicles.

Test for noise with the squelch control 'open' and on an unoccupied channel or with a weak signal. Then start the engine. Ignition noise will probably be present at all engine speeds. If it is severe, it may make normally readable, strong signals completely unreadable.

To reduce ignition noise, commence by installing resistor-type spark plugs if these are not already installed. If these are unobtainable, proceed as follows. If resistance ignition wiring is used it is often better to replace this with ordinary wire type ignition wiring and install suppressor resistors in each spark plug lead as well as the distributor lead. Alternatively, spark plug 'suppressor caps' which include a resistor may be installed between the spark plug connector and the ignition line. Complete ignition suppressor kits can be obtained from both automotive suppliers and transceiver suppliers for four, six and eight cylinder engines.

A special 'coaxial' suppressor capacitor should be installed on the 'hot' terminal of the ignition coil primary at least, and preverably on both terminals. These may be obtained from transceiver suppliers, electronic components suppliers or automotive parts suppliers.

A 'whining' noise which varies with the engine speed and, in cars etc, which continues with the engine ignition turned off and the vehicle coasting in gear, is characteristic of the alternator. Check and clean the rings if this has not already been done. Another coaxial capacitor should be installed on the alternator output lead as well. These may be obtained from the sources mentioned above. Special filters are obtainable for this application as well and may be somewhat more effective; both may be used in conjunction. They usually consist of a coil and a 'trimmer' capacitor. They should be installed as per the manufacturer's recommendations, the trimmer capacitor being adjusted to minimise the whine experienced in the receiver.

A general diagram illustrating these measures is given in Figure 4.

An irregular clicking sound which disappears at a slow idle, characterises voltage regulator interference. To suppress this, obtain a 'half watt' resistor having a value between 3.9 ohms and 5.6 ohms and a capacitor having a value of 0.0022 μF (or 2200 pF, also referred to as 2.2 nF or 2n2). Connect one end of the resistor on to the 'Field' terminal of the regulator, as close as possible. Connect one lead of

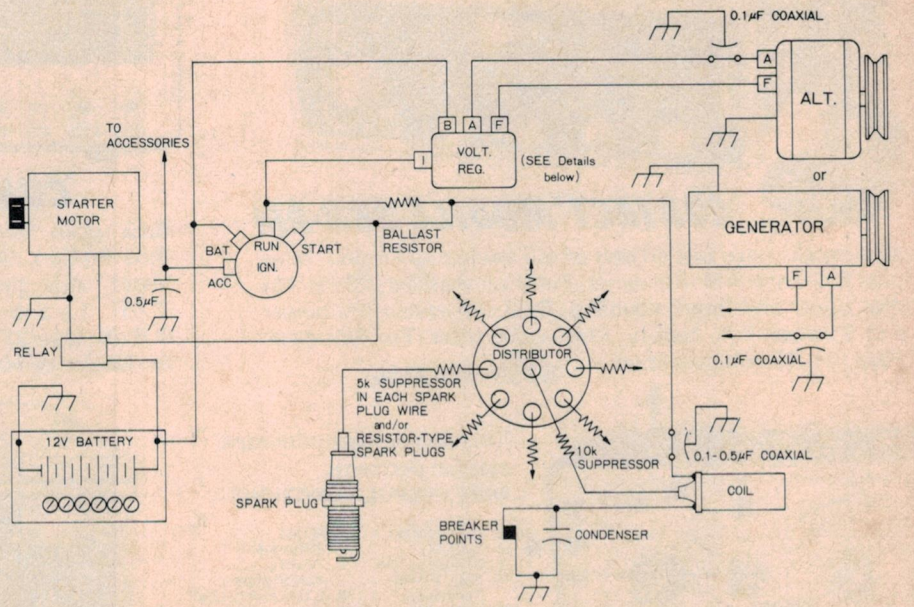


Fig. 4. Typical methods of suppressing noise from engine ignition systems and alternator or generator.

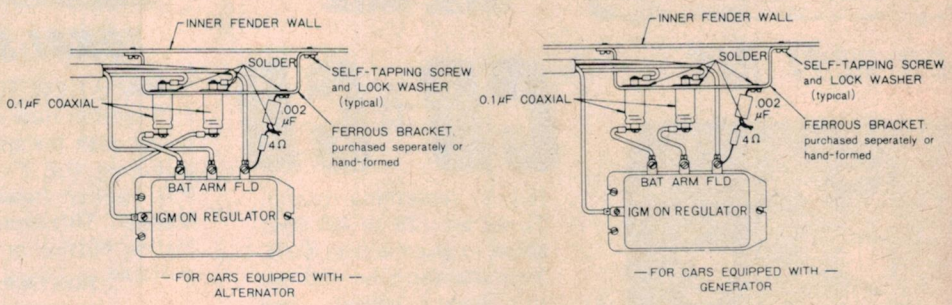


Fig. 5. Suppressing regulator noise — typical methods.

the capacitor to the other end of the resistor, with as short leads as possible. Connect the other lead of the capacitor to the nearest possible grounding point — use one of the regulator mounting bolts. **Solder** all connections. This is detailed in Figure 5. Two coaxial capacitors should also be installed in the 'Battery' and 'Armature' leads to the regulator.

In cars and trucks etc, irregular popping and crackling noises may be heard. These may be caused by static discharges at any of several locations on the vehicle or bad electrical contact between different portions of the vehicle. Tighten loose nuts and bolts and bond large areas such as the fenders, exhaust pipe (particularly this one), the firewall, etc, to the vehicle frame with lengths of heavy braid. Make sure that good electrical contact is made.

Some very good additional information can be obtained from several radio amateurs' handbooks. The 'Radio Amateurs Handbook' and the 'Mobile Handbook', both published by the American Radio Relay League (ARRL), are excellent. Good information is also available in the 'Radio Communication Handbook' published by the Radio Society of Great Britain (RSGB).

Some transceiver suppliers and electronic component supply houses stock a complete noise suppression kit for vehicles which is generally quite suitable for most installations. Some types feature a completely shielded ignition system which is particularly effective.

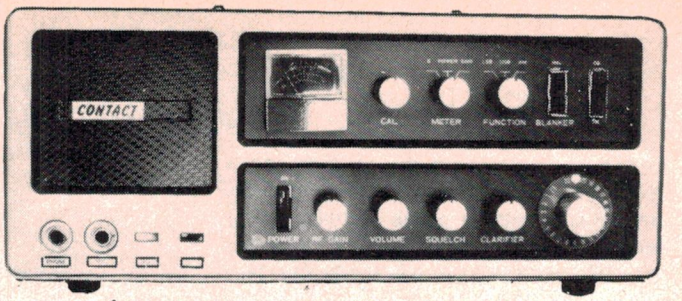
Having suppressed your own vehicle engine noise you will then find that many other vehicles 'offend'. Use your transceiver ANL or Noise Blanker switch. It may not be perfect — but it's way ahead of whatever is in second place!

While we're at it — a little piece of advice. NEVER, unless absolutely unavoidable, install a base station near a parking area. Obvious, dear Watson! The SLSA base station at Dee Why beach in Sydney could explain in graphic detail.

'CONTACT' MOBILE SSB·AM

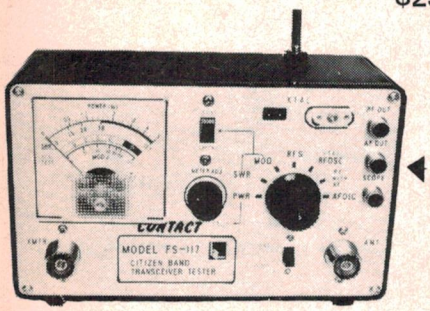
New stocks have just arrived of our beefed up version. Now puts 6.5 watts AM into aerial. Fully synthesized. 23 Ch AM plus upper and lower sideband. Dual conversion AM power and S meter. P.A. facility, xtal lattice filter. For Novice or Ham use. 12 volt operation.

$239 P&P $4.00



'CONTACT' BASE SSB·AM

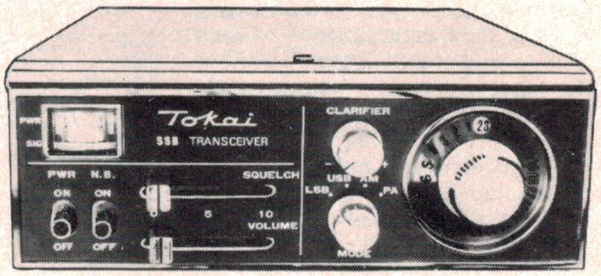
Back again for Feb. delivery **'THE CONTACT'** AM-SSB Base Station. 240 volt or 12v operation. Large R.F. & S. Meter. also gives S.W.R. A.M. blanker. Dual conversion 7 I.F. T.s and 6 I.F. stages. Delta tune sensitivity. .5UV @ 6 dB. Sixe 33" x 24.5" x 13.5". Weight 7¾ KG. Designed for Novice or Ham operation. **$299** P&P $5.00



This handy little miniature test lab performs
NINE USEFUL FUNCTIONS

1. Wattmeter
2. S.W.R.
3. Modulation
4. Rel. Field Strength
5. R.F. Oscillator
6. X'tal Checker
7. Audio Oscillator
8. Low Freq.Osc.
9. 5 Watt Dummy Load

$54.95 PP $3.00



TOKAI SSB·AM 25 WATT P.E.P.

TOKAI'S NEW TC1001 has also gone for more power. The SSB section now delivers 25W P.E.P. The price is commensurate with the quality. Full metal case. 81 semiconductors including F.E.T's. Triple AM and dual SSB conversion. P.A. facility. Power and S meter. Delta tune on AM. Noise blanker. This one is loaded with features. For the discriminating Novice or Ham. Porta pak available makes it into portable. **PORTA PAK $69** incl. aerial. **MOBILE $289.** P&P $4.00

CB TEST RIG

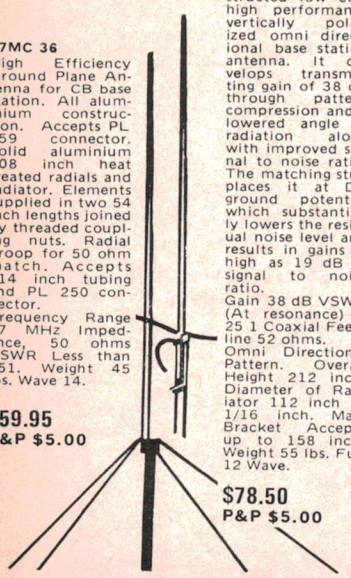
AERIAL MATCHER

CB ☆ CB

Here's something useful. Tunes any 25 to 40 MHz aerial to give the best SWR. You shouldn't be without this handy gadget. New shipment just in.

$15
P&P $2.00

Ground Plane Antennae

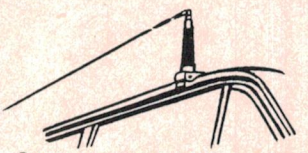


27MC 36
High Efficiency Ground Plane Antenna for CB base station. All aluminium construction. Accepts PL 259 connector. Solid aluminium 108 inch heat treated radials and radiator. Elements supplied in two 54 inch lengths joined by threaded coupling nuts. Radial droop for 50 ohm match. Accepts 114 inch tubing and PL 250 connector.
Frequency Range 27 MHz Impedance, 50 ohms VSWR Less than 151. Weight 45 lbs. Wave 14.

$59.95
P&P $5.00

27MC GPV BASE LOADED
A ruggedly constructed low cost high performance vertically polarized omni directional base station antenna. It develops transmitting gain of 38 dB though pattern compression and a lowered angle of radiation along with improved signal to noise ratio. The matching stub places it at DC ground potential which substantially lowers the residual noise level and results in gains as high as 19 dB in signal to noise ratio.
Gain 38 dB VSWR (At resonance) 1 25 1 Coaxial Feedline 52 ohms. Omni Directional Pattern. Overall Height 212 inch. Diameter of Radiator 112 inch to 1/16 inch. Mast Bracket Accepts up to 158 inch. Weight 55 lbs. Full 12 Wave.

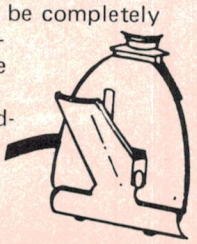
$78.50
P&P $5.00



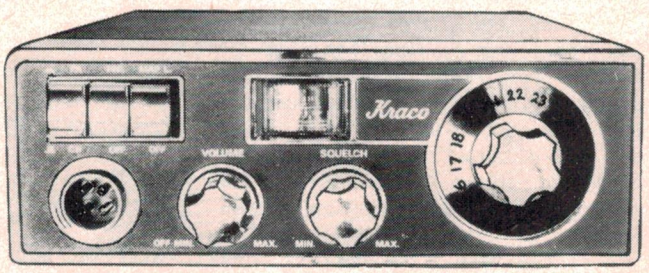
Our new delux folding gutter grip aerial heavy duty loading coil and fold down S/s tip. Snap locks automatica!ly when raised. Loading coil and tip can be removed just leaving gutter grip in position for max security. Complete with cable and plug. **$47.95** P&P $3.00

Guttergrips

Snap on gutter grip. Goes on in a jiffy. Can be completely removed in seconds. Complete with cable & PL259 plug. Adjustable tip for best SWR.



$23.95
P&P $2.00



KRACO 23 CHANNEL AM 5 WATT

SPECIAL BUY LIMITED QUANTITY

This exciting American style CB Transceiver is loaded with features. Apart from its smart black all metal cabinet it has a functional and attractive chrome control panel surround. Heavy duty control knobs with finger grips. Positive push button controls for automatic noise limiter. Public address. A most useful map lite is also incorporated. Illuminated channel indicator, variable squelch etc. 29 semiconductors plus I.C. dual conversion. FOR NOVICE OR HAM USE.

PRICE $149.00 P&P $3.00

PETER SHALLEY
CB SPECIALIST
554 PACIFIC HWY KILLARA
NSW 2071 TEL·4982611

KITS FOR ETI PROJECTS

We get many enquiries from readers wanting to know where they can get kits for the projects we publish. The list below indicates the suppliers we know about and the kits they do.

Any companies who want to be included in this list should phone Steve Braidwood on 33-4282.

Key to the companies:

- **A** Applied Technology Pty. Ltd. of Hornsby, NSW.
- **C** Amateur Communications Advancements, PO Box 57, Rozelle, NSW.
- **D** Dick Smith Pty. Ltd. of Crows Nest, NSW.
- **E** E.D. & E. Sales, Victoria.
- **J** Jaycar Pty. Ltd. of Haymarket, NSW.
- **L** Delsound Pty, Queensland.
- **N** Nebula Electronics Pty. Ltd. of Rushcutters Bay, NSW.
- **O** Appollo Video Games of Hornsby, NSW.
- **P** Pre-Pak Electronics of Croydon, NSW.

ETI 044	Two-Tone Doorbell	A
ETI 043	Heads or Tails	A
ETI 061	Simple Amplifier	A
ETI 068	LED Dice	A
ETI 101	Logic Power Supply	E
ETI 102	Audio Signal Generator	E,D
ETI 103	Logic Probe	E
ETI 107	Widerange Voltmeter	E
ETI 108	Decade Resistance Box	E
ETI 109	Digital Frequency Meter	E
ETI 111	IC Power Supply	E
ETI 112	Audio Attenuator	E
ETI 113	7-Input Thermocouple Meter	P E
ETI 116	Impedance Meter	E
ETI 117	Digital Voltmeter	E,A
ETI 118	Simple Frequency Counter	E,A
ETI 119	5V switching regulator supply	E
ETI 120	Logic Probe	L E
ETI 121	Logic Pulser	L E
ETI 122	Logic Tester	E
ETI 123	CMOS Tester	E
ETI 124	Tone Burst Generator	E
ETI 128	Audio Millivoltmeter	L E
ETI 129	RF Signal Generator	L E
ETI 131	General Purpose power supply	E,N
ETI 206	Metronome	E
ETI 218	Monophonic Organ	E,D
ETI 219	Siren	E
ETI 220	Siren	E
ETI 222	Transistor Tester	E
ETI 232	Courtesy Light Extender	E
ETI 234	Simple Intercom	E
ETI 236	Code Practice Oscillator	E
ETI 239	Breakdown Beacon	E
ETI 301	Vari-Wiper	E
ETI 302	Tacho Dwell	E
ETI 303	Brake-light Warning	E
ETI 309	Battery Charger	P E
ETI 312	CDI Electronic Ignition	P E
ETI 313	Car Alarm	E,D
ETI 401	Audio Mixer FET Four Input	E
ETI 403	Guitar Sound Unit	E
ETI 406	One Transistor Receiver	E
ETI 407	Bass Amp	E
ETI 408	Spring Reverb. Unit	E
ETI 410	Super Stereo	E
ETI 412	Music Calibrator	E
ETI 413	100 Watt Guitar Amp	P L E J,D
ETI 413	x 2 200 Watt Bridge Amp	E
ETI 414	Master Mixer	E,J
ETI 414	Stage Mixer	E
ETI 416	25 Watt Amplifier	E
ETI 417	Amp Overload Indicator	E
ETI 419	Guitar Amp Pre-Amp	P E,D
ETI 420	Four-channel Amplifier	L E
ETI 420E	SQ Decoder	E
ETI 422	International Stereo Amp	L E,D
ETI 422B	Booster Amp	E
ETI 422	50 Watt Power Module	E
ETI 423	Add-On Decoder Amp	E
ETI 424	Spring Reverberation Unit	L E
ETI 425	Integrated Audio System	E
ETI 426	Rumble Filter	E
ETI 427	Graphic Equaliser	L E,J
ETI 430	Microphone Line Amp	E
ETI 433	Active Crossover	E,J
ETI 435	Crossover Amp	E,J
ETI 436	Dynamic Noise Filter	E
ETI 438	Audio Level Meter	L E
ETI 440	Simple 25 Watt Amp	L E
ETI 441	Audio Noise Generator	L E
ETI 443	Compressor-Expander	E,J
ETI 444	Five Watt Stereo	E,N
ETI 445	Preamp	J,E,D
ETI 446	Audio Limiter	J,E
ETI 447	Phaser	E,J
ETI 449	Balanced Mic Preamp	J
ETI 502	Emergency Flasher	E
ETI 503	Burglar Alarm	E
ETI 505	Strobe	L E,D
ETI 506	Infra-Red Alarm	E
ETI 509	50-Day Timer	E
ETI 512	Photographic Timer	E
ETI 513	Tape Slide/Synchroniser	E
ETI 514	Flash Unit — Sound Operated	E
ETI 515	Flash Unit — Light Operated	E
ETI 518	Light Beam Alarm	E
ETI 522	Photographic Timer	E
ETI 523	Sweep Generator	E
ETI 525	Drill Speed Controller	E
ETI 526	Printimer	E
ETI 527	Touch Control Light Dimmer	E
ETI 528	Home Burglar Alarm	P E
ETI 529	Electronic Poker Machine	E
ETi 533	Digital Display	L E,A
ETI 534	Calculator Stopwatch	A,D
ETI 539	Touch Switch	E
ETI 540	Universal Timer	E
ETI 541	Train Controller	E
ETI 601		
4600	Synthesiser	J
3600	Synthesiser	J
ETI 602	Mini Organ	E,A,D
ETI 630	Hex Display	A
ETI 701	TV Masthead Amplifier	E,D
ETI 702	Radar Intruder Alarm	D
ETI 703	Antenna Matching Unit	E
ETI 704	Crosshatch/Dot Generator	L A,D,E
ETI 706	Marker Generator	E
ETI 707	Modern Solid State Converters	C,E
ETI 740	FM Tuner	A
ETI 708	Active Antenna	E
ETI 710	2 metre Booster	C,E
ETI 780	Novice Transmitter	E
ETI 804	Selecta-Game	O A,D

NOW . . . FROM IMC

THE $58.00 DPM plus sales tax

IMC

- $58 Single Unit Price
- 150 Hour Burn in
- Zero and Full Scale Front Panel Adjustments
- 3½ Digit, 4" LED Display Standard
- Accuracy to 0.05 %
- 5 vdc Power Input Standard . . . 12 vdc or 115-230 vac 50-60 hz Optional
- DIN Standard Case Dimensions

THE IMC SERIES 500. The only DPM designed to sell (in quantity) for less than $58.00 is here. Built to the same high standards as the IMC Series 300 DPM, the new series 500 offers the user the advantages of a digital meter at a price competitive with analog meters. Also available as a kit.

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NATIONWIDE ELECTRONICS

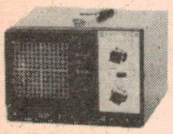
P.O. BOX 184
PENNANT HILLS. 2120

As our name implies we are electronic component discounters and because of our extensive mail order business with no shop overheads we can offer you your individual requirements at very reasonable prices. Most of you know us as we have been in the electronics industry for some forty years – therefore we are no "fly-by-nighters" and there's no chance of being duped. We stock a full range of the standard capacitors, resistors, plugs and sockets, matrix board, vero board, transformers, values, semiconductors, I.C.'s – you name it – just write for a quote or send us what you estimate is the correct selling price (if not presented in one of our ads) and we will adjust order to suit and remit a cheque if you have overestimated. Because of the large amount of interest shown due to our starting up in business again, we would like to take this opportunity to thank our customers for their enormous support which we feel will help us keep our selling prices as low as possible. Just look at this months fantastic offers: Famous TRIO test equipment with up to 20% off some of our competitors prices; The fabulous CORAL 12SA1 kit at $87 – thats well under recommended retail; Resistors at bulk buy prices in any quantity you want – But last and indeed not least is our 23 channel CB mobile transceiver at the lowest price in town – $83 – and all last months prices are held as advertised. All our products are brand new and carry at least three months guarantee – Bill and Norm Edge.

★Now with 5MHz bandwidth★

CO-1303D

75mm OSCILLOSCOPE



SPECIFICATIONS

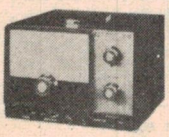
Bandwidth:	DC to 5MHz (–3dB)
Deflection factor:	10mV/div
Attenuator:	1, 1/10, 1/100
Input R.C:	1MΩ, 35pF
Sweep range:	10Hz to 100 kHz
Phsphor:	P31
Power:	AC 100/117/230V 50/60Hz, 16W
Dimensions:	W186 x H131 x D280 (mm)
Weight:	3.8 kg

- 75mm CRT
- DC-5MHz/10mV
- Compact & lightweight

$199 (Tax exempt)
$210 (Tax included)

SG-402

RF SIGNAL GENERATOR



SPECIFICATIONS

Frequency range:	100kHz to 30MHz in 6 ranges
Output voltage:	0.1 V rms
Int. Mod.	
Int. Mod.:	400Hz, 40% modulation
Ext. mod.:	1.5V rms, 50Hz to 10kHz
Power:	AC100/117/230V 50/60Hz, 3W
Dimensions:	W186 x H131 x D220 (mm)
Weight:	2.2 kg

- Wide frequency range
- Compact
- Amplitude modulation facility

$96 (Tax ex.)
$100 (Tax inc.)

TRIO

★See E.A. June 74.★

AG-202A

CR OSCILLATOR

SPECIFICATIONS

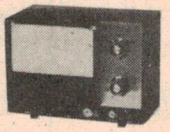
Frequency range:	20hz to 200kHz in 4 ranges
Output impedance:	600Ω
Output voltage:	Sine wave: 10V rms; Square wave: 10Vp-p
Sine wave distortion:	0.5% (50 Hz to 100kHz)
Square wave response:	10% Sag 3% Overshoot
Power:	AC 100/117/230V 50/60Hz, 5W
Dimensions:	W186 x H131 x D220 (mm)
Weight:	2.8 kg

- Wide frequency range
- Sine and square wave signals
- High output stabilized voltage

$129 (Tax ex.)
$137 (Tax inc.)

VT-108

VOLT-OHM METER



SPECIFICATIONS

Voltage Range:	DC: 0.5V to 1,500V f.s. in 8 ranges AC: 1.5V to 1,500V rms f.s. in 7 ranges 4.2V to 4,200V p-p f.s. in 7 ranges
Input, R.C:	DC: 11MΩ AC: 1MΩ, 145pF at 1.5V to 150V ranges 1MΩ, 80pF at 500V to 1,500V ranges
Frequency range:	15Hz to 5MHz
Ohm range:	0.1Ω to 1,000MΩ in 7 ranges
	Batt. operation: 4 x UM3's, 1 UM1
Power:	AC operation: AC 100/117/230V available with AD-108
Dimensions:	W186 x H131 x D105 (mm)
Weight:	2 kg

- Multipurpose use
- DC operation
- Memory circuit

$108 (Tax ex.)
$115 (Tax inc.)

CB

23 Channel Mobile Transceiver (SR-76)

ONLY **$83**

This machine for this give away price has got to be the best CB deal in Sydney. Just read these features – but remember – a limited quantity only available. This unit is a compact, all-transistorised, 23 channel AM Citizens Band Transceiver. This model, because of its low current drain, is ideally suited for mobile operation from 11V negative or positive ground DC power source. The receiver has a sensitive superheterodyne circuit with IC power amp featuring: Dual conversion, low noise RF stage, adjustable squelch, automatic noise limiting, S meter, cermaic filter, external speaker jack plus internal speaker, and instantaneous selection of any of the 23 crystal controlled channels. The transmitter final is a conservatively rated high gain RF power transistor.
Specifications: General: 23 crystal controlled channels, size 5"(w) x 1¾"(H) x 7¾"(D), weight 2.5lbs, Antenna impedance 50 ohms. Power 13.8V DC (Negative or Positive Ground).
Receiver Specs: Frequency Range 26.965 MHz to 27.255 MHz, sensitivity 1μV at 6 dB S/N, Selectivity 60 dB bandwidth 20 KHz, Spurious rejection 60 dB min., Squelch range adjustable from 1μV to 1000μV, Automatic Noise Limiter, 1st I.F. Frequency 10.6 MHz centre frequency, 2nd I.F. Frequency 455 KHz, PA maximum audio output 4 watts, speaker 8 ohms, 3" diam.
Transmitter Specs: Frequency Range 26.965 MHz to 27.255 MHz, Output Power 3 watts into 50 ohms with 13.8V DC power supply, Frequency Tolerance ±0.005% (-30°C to +65°C) Modulation Capability more than 80%, Spurious and Harmonics Suppression 50 dB minimum.
Model SR-76 Shigma Transceiver only $83.

CORAL 12SA-1 SPEAKER KIT ONLY $87

This kit gives you everything you need to make a pair of the best sounding speakers boxes for well under $200. In this kit everything is supplied except the boxes themselves, the innerbond for the inside of the boxes and the front grill – and by everything we mean everything – right down to the screws to screw in your speakers. And we aren't being flattening when we say some commercial units over $400 don't sound as good. In each kit comes all the instructions you need to build your own boxes or we can supply (see our ad ETI JAN 77). Each box employs one 12 inch bass speaker, one 5" midrange speaker and two 2½" tweeters plus a three way cross-over network.

Some of the features and ratings are as follows:

RESISTORS
All one price no matter what quantity you require. You don't have to be a manufacturer and buy in hundreds to qualify for our price – buy one or one thousand – all one fantastic price:

⅛ WATT	5% Resistors (2.2Ω – 4.7 meg)	3c ea
¼ WATT	5% Resistors (10Ω – 470 K)	3cea
1 WATT	5% Resistors (10Ω – 10 meg)	7cea
5 WATT	BLOCK Type Resistors (.33Ω – 4.7 KΩ	32cea
10 WATT	BLOCK Type Resistors (1Ω – 1.5KΩ	48cea

DELIVERY CHARGES – No minimum charge. $0-$5 = 50c, $5.01-$15.00 = $1.00, $15.01-$25 = $1.50, $25.01-$50 = $2, $50.01-$100 = $3, $101 or more = $4 – all above charges are by post. All heavy items will be sent "Freight-On" through Comet. No packing charges. For C.O.D. please send $3 deposit. Please send an extra 1% of order value if insurance is required.

TANTALUM CAPACITORS – Micro miniature resin dipped tantalums offers the advantages of Tantalum at prices comparable with aluminium electrolytics. Superior dielectric gives high temperature stability and long life. Uni directional leads for PCB mounting. – Just look at these low, low prices for one off or one thousand off. . . 0.1μF at 35V to 0.68μF at 35V only 22c ea., 1μF at 35V to 4.7μF at 35V only 28c ea., 6.8μF at 25V only 34c, 10μF at 25V only 36c, 15μF at 16V only 36c, 22μF at 10V only 40c, 33μF at 10V only 42c, 47μF at 6.3V only 42c, 100μF at 3.15V only 42c.

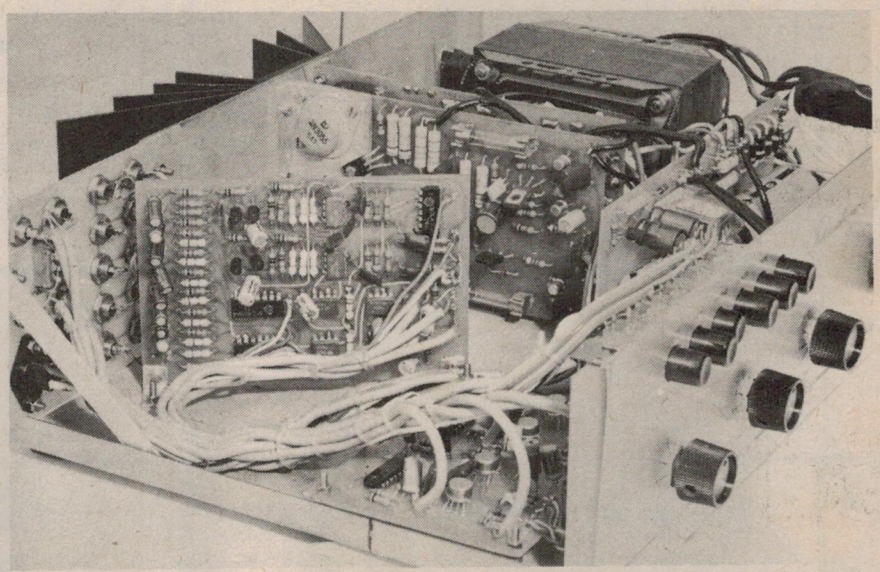
STEREO AMPLIFIER

* 50W/channel
* CMOS switching
* rumble filter
* scratch filter
* modular

The final part of this project with details of the pc boards,front and rear panels and the metalwork.

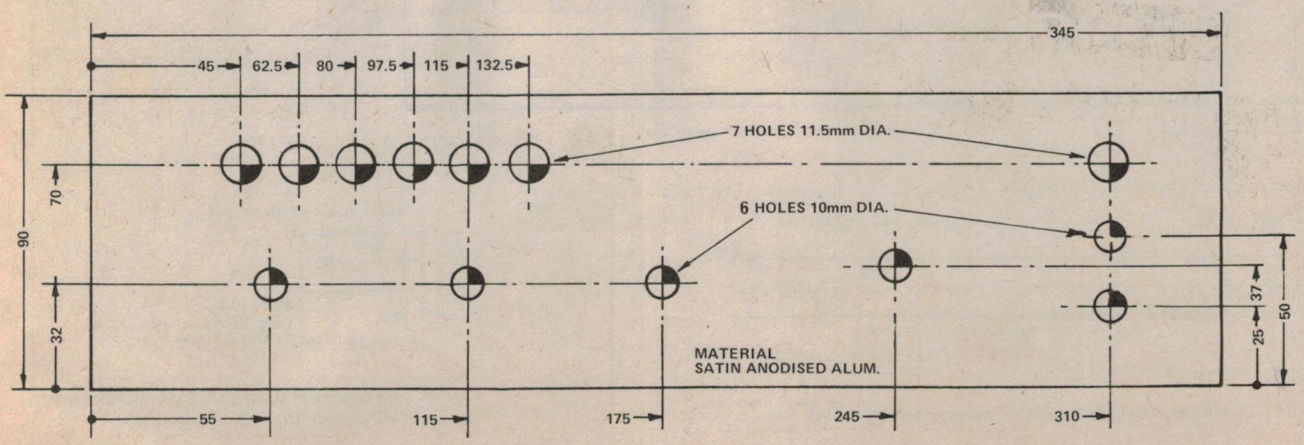
LAST MONTH WE PUBLISHED THE technical details of the 482 50 W per channel stereo amplifier; this month we give the mechanical specifications and the pcb designs for the preamp board and the tone control board.

This completes our plans for this project.



An internal view of the amplifier.Note that the preamp baord is pivoted out and not in its final position which is parallel with the rear of the unit.

Fig 1. Details of the front panel.



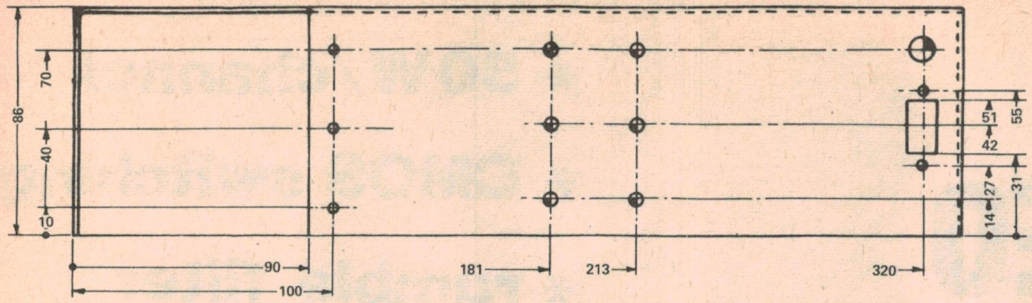
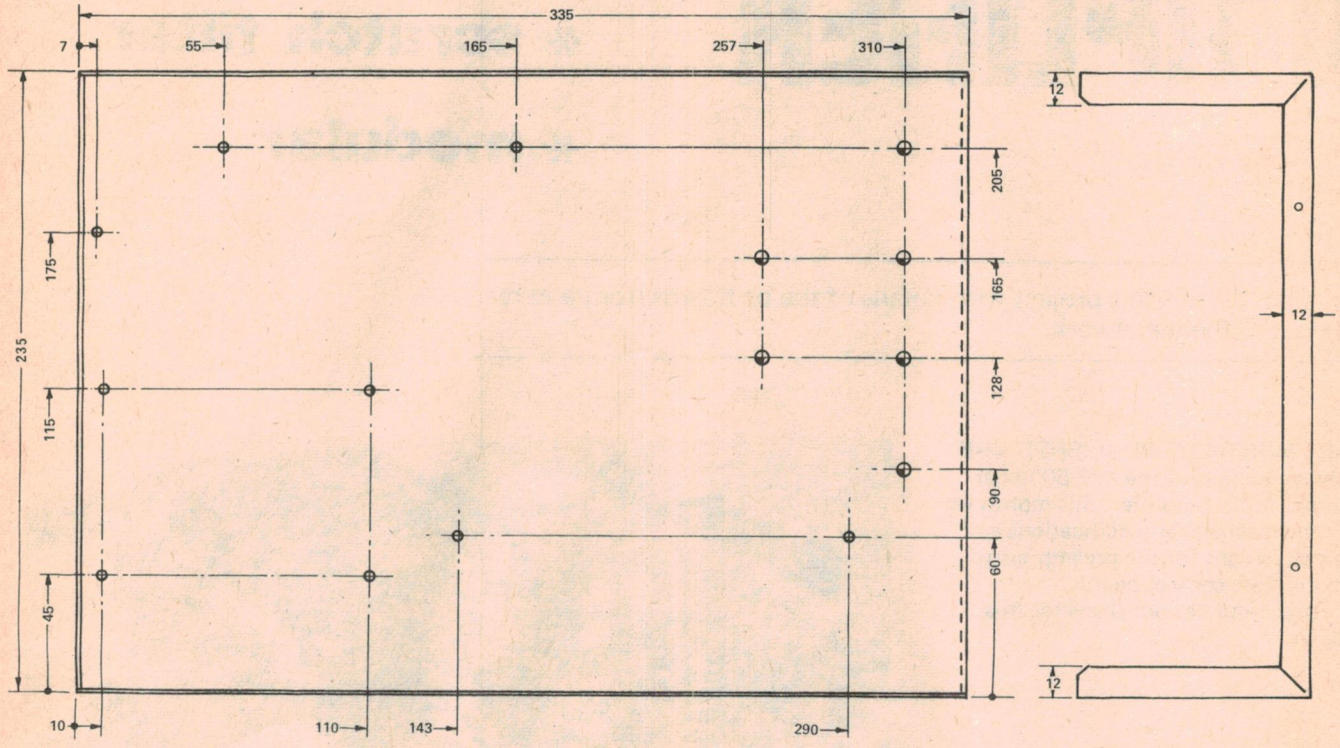
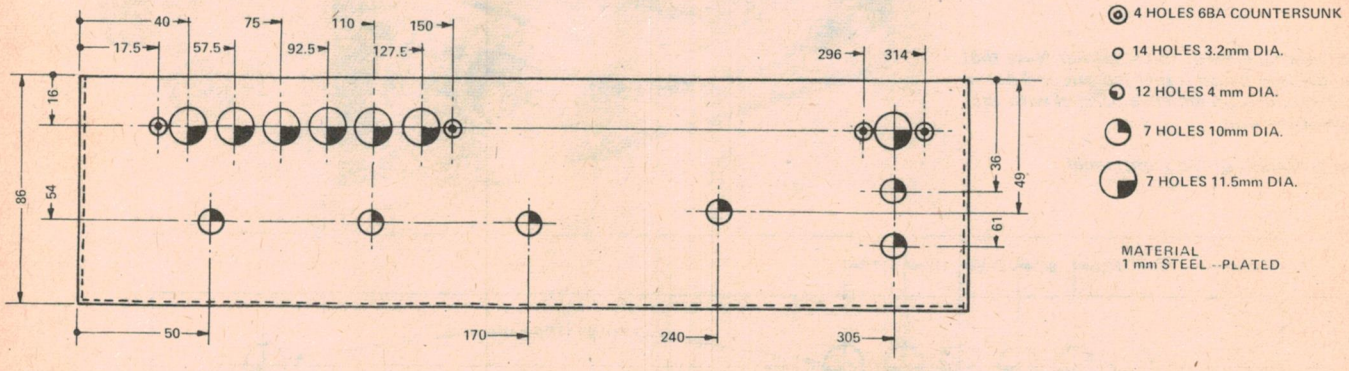


Fig 2. Details of the chassis.





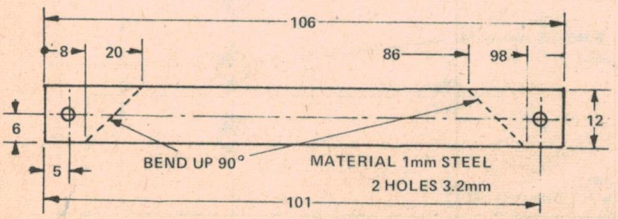


Fig 3. The bracket used to support the rear panel.

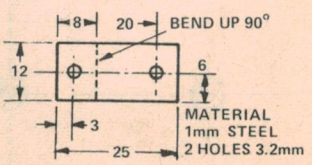
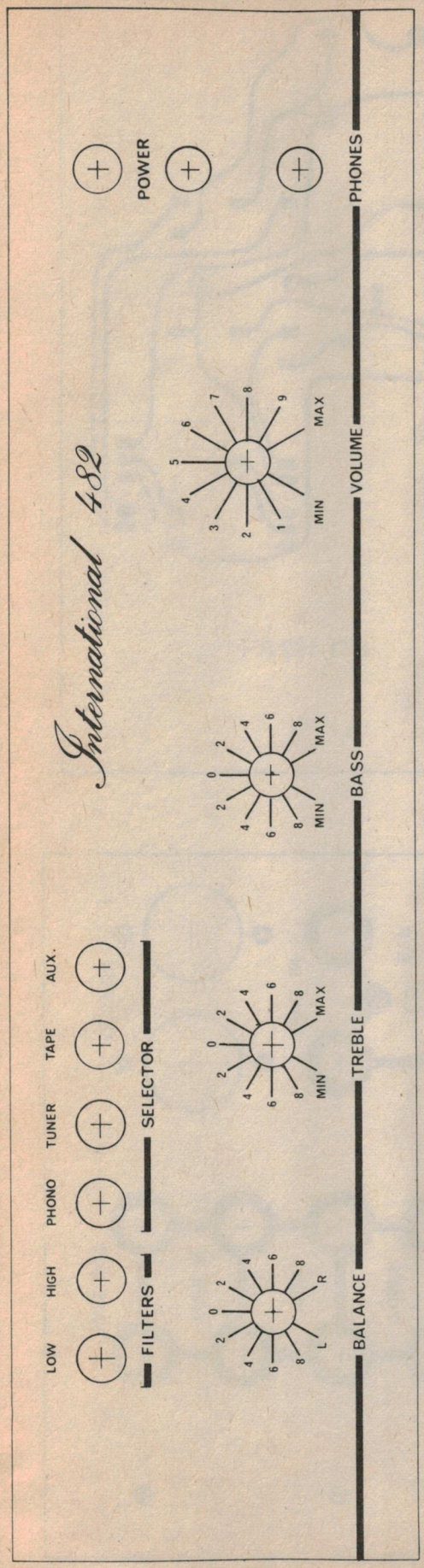


Fig 4. The brackets used to support the preamp and power supply boards. 4 required.



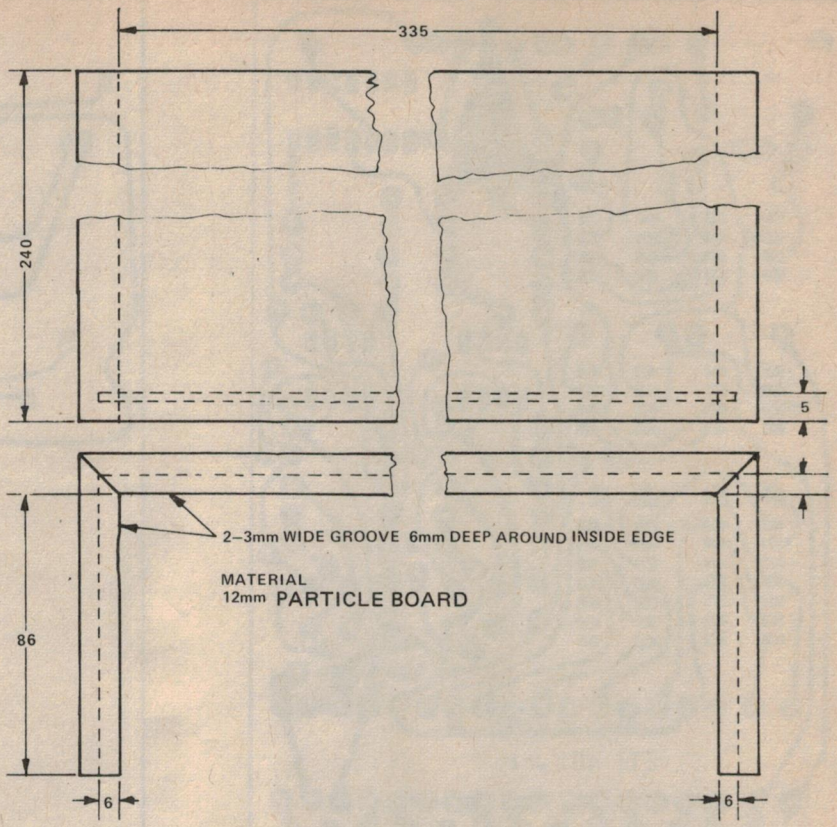
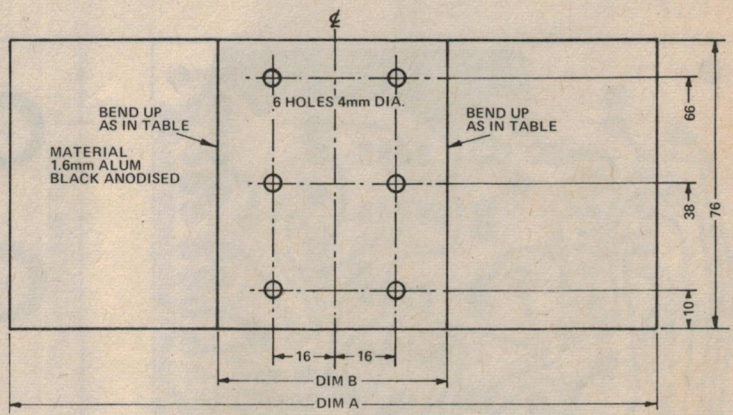


Fig 5. The wooden cover.



	DIM A	DIM. B	ANGLE
ITEM 1	110	40	75°
ITEM 2	130	50	60°
ITEM 3	170	60	45°
ITEM 4	230	70	30°

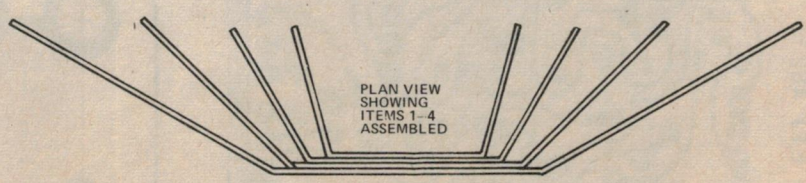
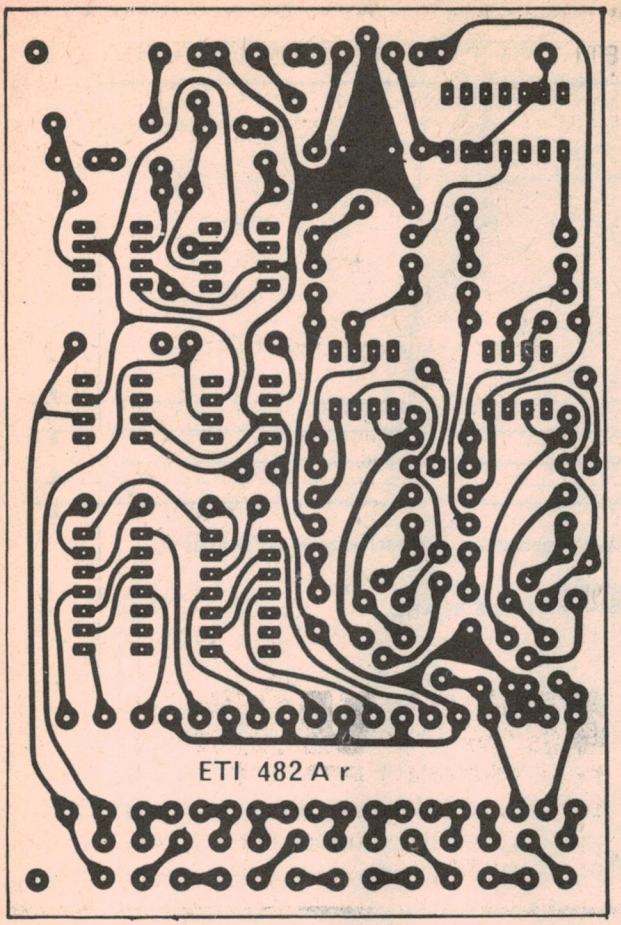


Fig 6. Details of the heatsink used.



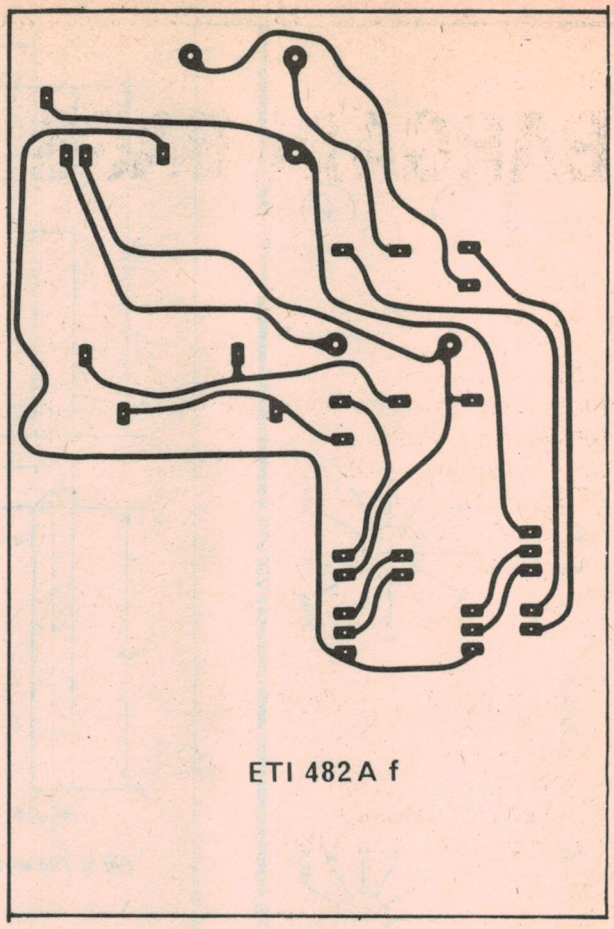


Fig 7. Printed circuit layout(both sides) of the preamp board. Full size 120 x 80 mm.

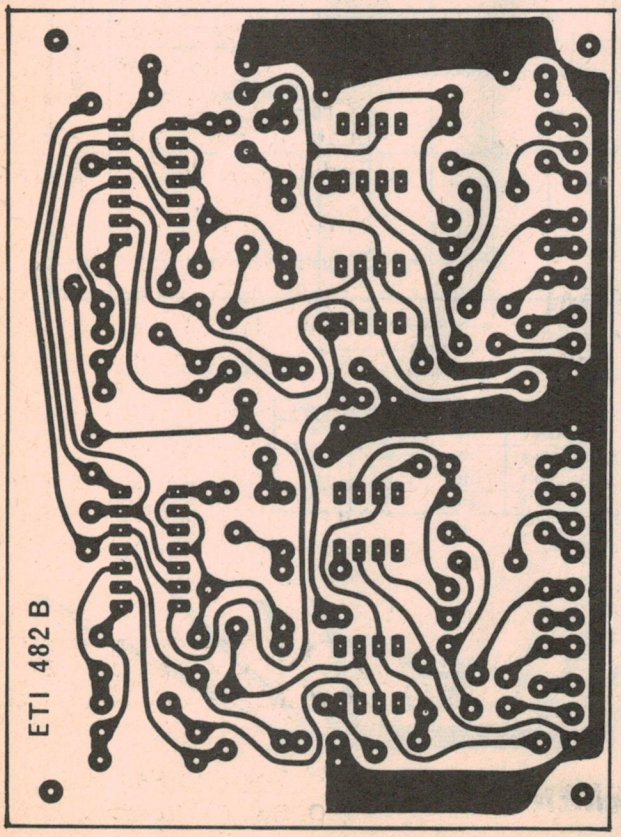


Fig 8. Printed circuit layout of the tone control board.Full size 110 x 80 mm.

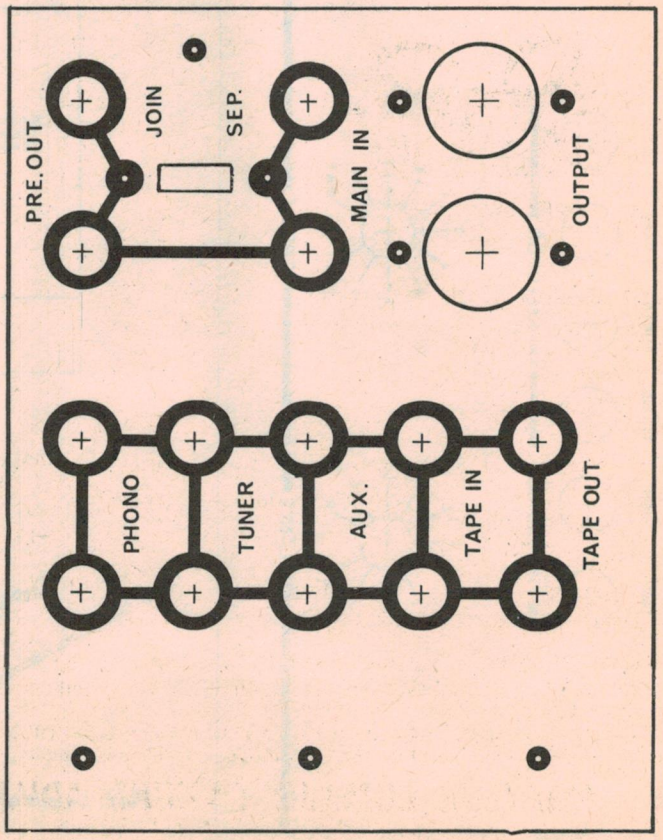


Fig 9. Details of the rear panel. Material 1.6mm fibreglass 1oz cu board.

BARGAIN BAGS

3 tuning gangs	$1.00
5 ferrite rods	1.00
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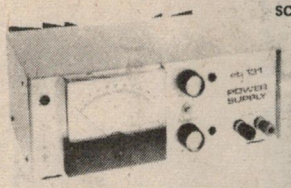

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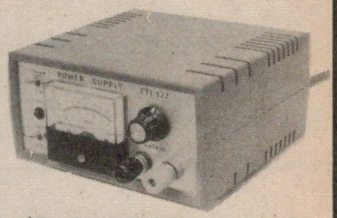

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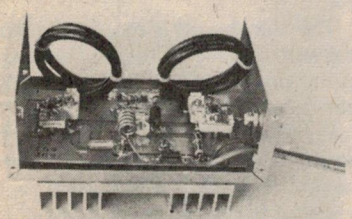

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Project 244

ALARM ALARM

By A. J. Lowe.

A car thief seeing the 'Alarm Active' beacon of this project is guaranteed to pick someonelse's car. Unless he is an ETI reader . . .

ONE PROBLEM WITH BURGLAR alarms is that they don't 'go off' until the burglar has broken in, but here is a project which can be installed in a car to warn thieves that a burglar alarm is operating. It should warn a thief to go and find a car which is not owned by an ETI reader! Even if there is actually no burglar alarm, the 'alarm alarm' can still be used. It's what the car thief believes that counts – and he's not going to investigate to see whether there really is an alarm.

The unit is simply a box containing two lamps which flash slowly on and off, together, and shine through a Perspex panel to illuminate the words ALARM ACTIVE. It uses a 555 timer IC, which was described in Project 044 (October 1976). In this case the 555 is used as an astable multivibrator.

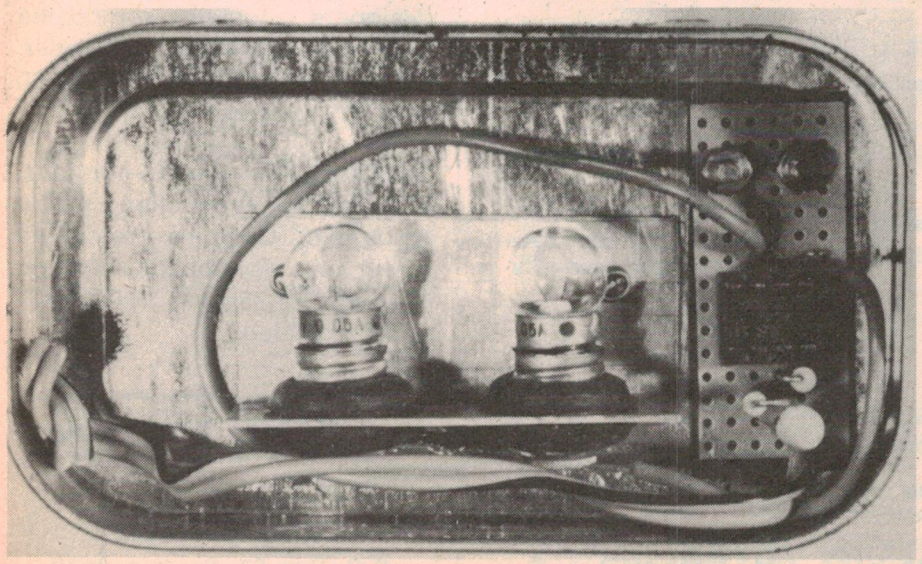
As the circuitry is isolated from the box this alarm can be used with any car with a 12 volt battery – whether the positive or negative terminal is connected to the chassis. Take care to see that the unit is correctly connected.

Construction

The prototype was built in a tobacco tin measuring 95 x 56 x 23 mm deep (see photo) but dimensions are not critical.

The circuit is very simple (see Fig. 1) and uses only four electronic components in addition to the lamps and lampholders. The prototype was constructed on Veroboard with holes 2.54 mm (one tenth of an inch) apart – as this is the spacing which fits the IC. A board with 6 tracks of copper and 15 holes in each track was used. The tracks were cut, using a small drill, where shown in Fig. 2.

Note that all six tracks are cut in row 11, to isolate the part of the board held by the mounting bolts. This prevents the bolts short-circuiting the tracks to which components are soldered.



The photo shows the two globes which flash to illuminate the 'Alarm Active' legend on the perspex window in the lid of the box. The other five components are mounted on the Veroboard.

Assemble the components as shown in the overlay diagram, Fig. 3. Resistors R1 and R2 are mounted vertically. Take care that the capacitor (C), which is an electrolytic tantalum type, is mounted the right way round. These capacitors are not marked with positive and negative signs so you have to know the rule: When you hold the capacitor so that the coloured dot is facing you, the right hand lead is the positive one. This lead must go into hole D2 as shown in the overlay diagram.

Two insulated jumper wires are fitted below the board. One joins pins 4 and 8 of the IC and the other joins pins 2 and 6. These wires are shown in the overlay diagram, but remember that they are below the board. Don't miss the bare wire link from hole A8 to B8.

It's a good idea, particularly for those who are not very experienced at soldering, to use a socket for the IC. The socket is soldered to the board and the IC plugged in later. This avoids the risk of damaging the IC by overheating it while soldering.

The photo of the inside of the 'Alarm Alarm' shows what the Veroboard looks like with all the components mounted. The lamps are screwed into suitable lampholders which are held by rubber grommets in an L-shaped bracket, about 47 mm long, made from a scrap of aluminium. The bracket is bolted or rivetted to the back of the box. Take care that no part of the lamp circuit touches the bracket or box.

The Veroboard is mounted into the box with a piece of plastic sheeting (for insulation) below it. Two small bolts near the unused end hold the board in place. The lead to the battery of the car should be clearly marked for polarity. Speaker extension flex is ideal for this as one of the wires is marked.

The illuminated panel in the prototype is a piece of white translucent Perspex with press on letters covered with clear Contact. This was fitted to the lid of the box after a hole of suitable size (60 x 30 mm) had been cut. If Perspex is not readily available then some inexpensive substitute could be used – such as the bottom of a white plastic margarine box.

Installation

The unit can be permanently mounted in a car near one corner of the windscreen and the wiring neatly run to a switch below the dashboard. Alternatively it may simply be placed in position when required, and plugged in to the cigarette lighter socket. To work effectively it should be prominent day or night.

Of course, if the car does actually have a burglar alarm then this device

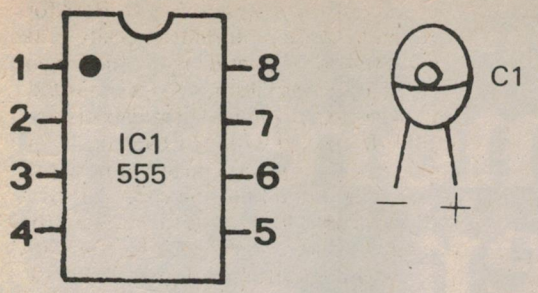
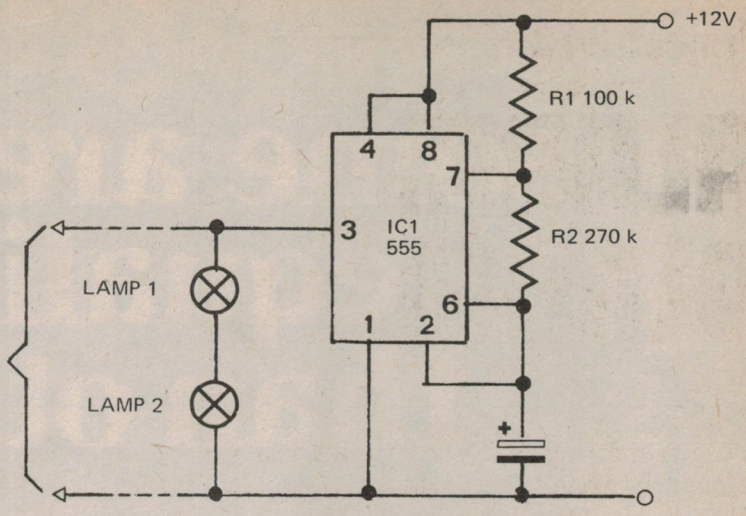


Fig.1. The circuit diagram of the Alarm Alarm.



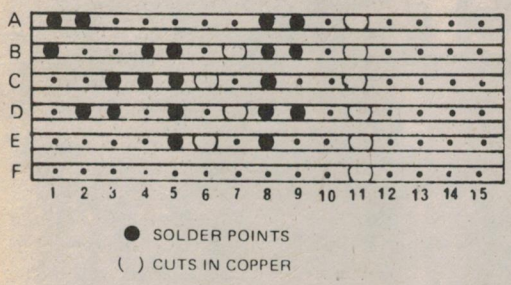


Fig.2. This shows the places where you have to cut the tracks in the Veroboard. After mounting the components as shown in Fig.3 the connections are soldered as indicated below.

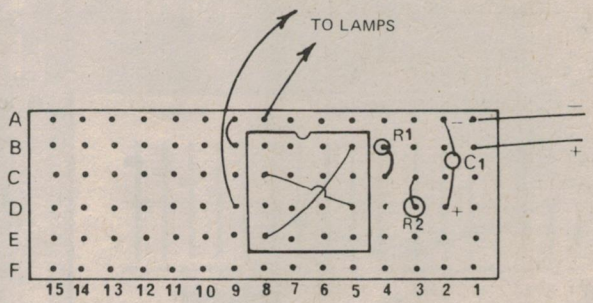


Fig.3. The view from the non-copper side of the Veroboard. The two link wires shown under the IC are not on the top of the board – they should be made on the copper side.

PARTS LIST

R1	Resistor 100k ¼ watt
R2	Resistor 270k ¼ watt
C	Tantalum electrolytic capacitor 4.7 µF 16 volts
IC1	Timer 555

Lamps 1 and 2, 6 volt 50 mA MES lamps (Philips type 7121D)
Veroboard, 38 mm x 16 mm 2.54 mm hole spacing.
Two lamp holders in rubber grommets
Hook up wire and lead to battery
Suitable box, scrap aluminium, pers perspex, etc.
Optional (but desirable) 8 pin DIL IC socket.

should be connected so that it is activated as soon as the burglar alarm is switched on.

The parts list specifies two 6 volt lamps of 50 mA rating which are connected in series. The current consumption is so low that the unit could be left operating for many hours without any danger of running down a car battery.

The IC is actually capable of switching up to 200 mA through pin 3, so there is no reason why two or even three slave units (with lamps only) should not be run in parallel with the lamps in the master unit. This could provide warnings at all vulnerable points in a car.

This same device can be used in windows of homes as a discouragement to house burglars. In this case it should be operated from a simple power supply running from the mains.

How It Works

The 555 IC is used as an astable (ie, not stable) multivibrator. As soon as it is connected to the supply it starts to oscillate (slowly in this case) and the output voltage at pin changes regularly and suddenly from high to low and low to high as the capacitor is charged and discharged. See Fig. 4.

The charge time (during which the output is high and the lamps are on) is given by the formula:

$$Tc = 0.69 (R1 + R2) \times C$$

and is in seconds when R1 and R2 are in megohms and C is in microfarads.

So $Tc = 0.69 (0.1 + 0.27) \times 4.7$

$= 1.2$ seconds

The discharge time (during which the output is low and the lamps are off) is given by the formula:

$$Td = 0.69 \times R2 \times C$$
$$= 0.69 \times 0.27 \times 4.7$$
$$= 0.88 \text{ seconds}$$

Total time of one osccilation = Tc + Td = 2.08 seconds. So, we have a flasher which is on for about 1 second in 2. The exact timing depends on the actual capacitance of the capacitor C, and this may differ from its rated value by as much as –20% and +50%.

The rate of flashing may be changed by changing the values of R1 and R2. Higher values cause slower flashing.

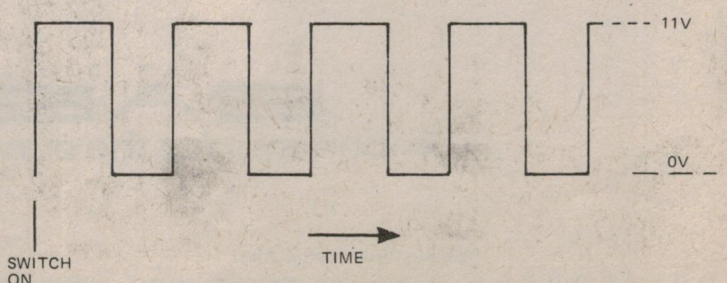


Fig.4. The voltage across the globes switches on and off as shown above.

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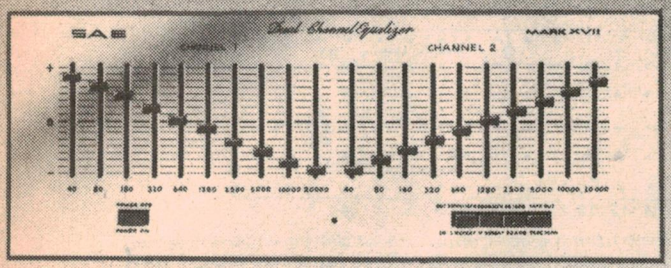

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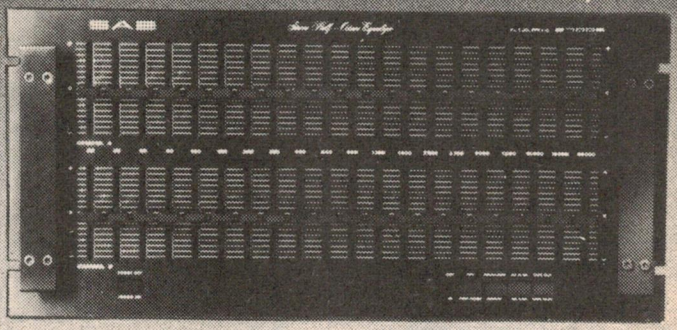

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PRINT-OUT

ETI's COMPUTER SECTION

FROM THE EDITOR'S CONSOLE . . .

This issue of Print-out is very much a club issue. There's already a club going in Newcastle and I am happy to report that the Sydney area club has finally been launched.

The Sydney club blasted off in November last year, but it was the January 17th meeting that really established the club in orbit. As the first public meeting it was a great success with 175 people packed into a hall with seating accommodation for only about half the number. By the end of the evening over 100 people had paid up their membership fee.

The meeting was chaired by the four-member steering committee set up at the November meeting. By the end of the evening a number of motions had been carried. The more noteable were the acceptance of a draft constitution, the decision to hold the next meeting on February 21, again at the WIA hall. And the name of the club to be 'MICROCOMPUTER ENTHUSIAST GROUP'.

A committee of nine were elected to run the club for the first six months, with a general election to be held at the end of that time.

To add flavor to the evening there was also a demonstration of micro-computers in action. A number of lucky people had personal bio-rhythm calendars worked out by one of the micros and printed on a lineprinter. Others tried to find their way out of a computer generated maze. ETI's key-board and video display were also demonstrated.

The club is still looking for active members so here are a few reasons why you should come along to the next meeting. They can be summarised with three words – Information, Friendship and Trade.

Information is one of the most important activities of a computer club. Such activity might be as formal as experienced members running training courses in hardware or software for inexperienced club members, or as informal as a social exchange of ideas between those with similar levels of experience. Of course, even the most advanced person in a field can benefit, since specialization is so common in these days of high technology that one can know all. Then, of course, the best example of this will be the exchange between the software and hardware types.

When two or more people share a common goal that is a subset of the computer world, say music or model trains, then you have a special interest group that can share ideas and experience. But where does one go to meet members of your particular special interest? Why, to a club of course. A club then can bring special interest groups together by making announcements at meetings or by putting notices in the club newsletter.

There are times when learning sessions need not be a one way affair. In a workshop session there is no one lecturer, everyone has a chance to speak up and express their views on the subject under discussion, and to debate on the validity of the popular beliefs about the subject.

Friendship. Computer enthusiasts are, after all, people, and like all human

CLUB REPORT

Dr Peter Moylan reports on the foundation of the Newcastle Microcomputer Club.

PERSONAL COMPUTING IN NEWCASTLE PASSED A SIGNIFICANT MILESTONE IN LATE 1976, WITH THE FORMATION OF A MICROCOMPUTER CLUB. THE INAUGURAL MEETING ON THE 26TH OF OCTOBER ATTRACTED 15 PEOPLE, AND A NUMBER OF APOLOGIES. FOLLOWING IS A REPORT ON THE CLUB'S PROGRESS SO FAR AND ITS PLANS FOR THE FUTURE.

The initial impetus for the formation of a club came from within the University of Newcastle. Microprocessors had been used in University research projects since 1975, and will be introduced into undergraduate electronics laboratories in 1977. This meant that there was already a pool of University staff members with interest and expertise in the area. The addition of several science students brought the numbers up to the point where a club was worth forming, therefore no attempt was made to obtain publicity outside the University. Despite this, several non-university people turned up to the first meeting.

It was clear from the outset that the club would be most successful if most of the members owned their own computer systems — and equally clear that most of those present were working on a very limited budget. What was needed was a complete microcomputer system costing somewhere in the range $50-100.

Even the cheapest of the existing evaluation kits did not meet this criterion, mainly because they required a teletype before they could be used.

Work was therefore started on designing a minimal system. The final design, with the prototype now in use, uses a SC/MP processor, a Motorola 6810 memory chip, and a front panel for data input and output. Unlike most microprocessor-based systems, there is no ROM, instead the front panel is used for initial program loading. For maximum flexibility and ease of future expansion, the system is built on three separate boards.

For the more ambitious, an 8080 processor board has been designed. This consists of an 8080A processor and supporting components (such as a clock and system controller), but no input-output or memory devices. These have been banished to separate boards, again in the interest of modularity.

The club also plans to use local designs for I/O interfaces and memory, in order to keep costs down. A video display has already reached the prototype stage, and a fully buffered 2K byte memory board is currently on the drawing board. Future projects will include a cassette tape interface, and perhaps a graphics display interface.

Beginners have not been forgotten. It is intended that from time to time talks will be given at club meetings on various aspects of setting up and using a microcomputer system. So far two topics have been covered, constructional techniques in building a microcomputer and 8080 programming.

The Newcastle Microcomputer Club meets on the second and fourth Tuesdays of every month, at the University of Newcastle. Those interested in further details should contact Peter Moylan, phone (049) 68-5256 (work) or (049) 52-3267 (home), or write to him at the Department of Electrical Engineering, University of Newcastle NSW 2308.

FROM THE EDITOR'S CONSOLE,
Continued from page 61...

creatures need to associate with other people of similar interests. But computer enthusiasts are relatively few. They are sparsely spread over a large area and have little chance of coming into contact with one another. The club then can serve the useful purpose of providing somewhere to meet people who share your own interests. In fact the social aspects of the computer club are very important because where else would you find a group of people willing to listen and converse with as much enthusiasm as another computer hacker?

Trade. Although some people look down at trade, it is a fact of life that without it there would be no microcomputers, so why not make it work extra for you. A computer club could organise such things as bulk buying of components, exchange of software and hardware designs (note that money need not change hands).

Another way to make commerce work for you is in the traditional flea market or auction sale, here your surplus equipment becomes someone else's pride and joy. As well, clubs could arrange for manufacturers' representatives to come along to the club meeting place and give short talks and demonstrations of their equipment. This means that club members get a first-hand look at the wonderful new gadgets being offered for sale.

Once clubs get under way in Australia there is no reason why nationwide affiliation of clubs could not happen. Such an affiliation could, for example, considerably improve and increase the exchange of information by co-ordinating the exchange of taped lectures and talks, not to mention programs and hardware designs. Such co-ordination would also make available extra talent to all affiliated computer groups. A national association would also be required if there ever was to be a set of Australia wide standards within the personal computing society.

The list of reasons given for a club is by no means a complete list. But the ones given are sufficient to show that the formation of computer clubs in Australia is worthwhile to the personal computerist. If you decide to start such a club in your area, then let ETI help you do it. Write us a letter with the details you wish to make public and we will include them in Print-Out for all to see. If your club is already going and needs more members, or if you wish to let others know of your existence, then let Print-Out carry the message; all it takes is a letter.

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PRINT-OUT's BOOK REVIEW

101 BASIC COMPUTER GAMES

The fascinating and delightful thing about being shown around a computer centre is the demonstration of the games package. If you have been a good visitor and said all the right things about the computer, then you will be rewarded by being allowed to watch an actual game being played. And if you have been extra good, you might even be allowed to play a game yourself. The only disheartening thing I remember about such visits is the smug expressions on the faces of the operators and programmers after the computer wallops you three times in a row.

Now with the advent of the personal computer it's possible to have your own computer and your own package of games to play. Before you can play a game, however, you must program the computer. One way is write your own software but this takes time and considerable imagination on your part. Fortunately there exists a ready made games package in the form of Digital Equipment's book, 101 BASIC Computer Games. This book contains details of some 108 games (7 are different versions of the same game) suitable for playing on a computer.

As the name of the book cleverly says, they are all written in the computer language called BASIC. This means to get one of the games running, by just copying it straight from the book, you will need a BASIC compiler to translate the game into machine code for your system. Even without a compiler the BASIC listing gives you the logic of the game so that you can write it yourself in machine code.

The presentation of each game in the book consists of a short descriptive write-up with comments on any special language or computer requirements, followed by a listing in BASIC of the required computer instructions. There is a reference to the author and, to put the readers in the appropriate mood, a humorous illustration about each game (one of many credited artists comes from Mad magazine) is included. A sample run is given to help explain the operation of each game.

It's impossible to give complete details of all the 108 games, but to give some idea, I'll list the family headings used in the book. They are: number or letter guessing games; piles of object games, like 23 Matches; matrix games, like Salvo; artificial intelligence games; land management and government games; gambling with games, like Poker; sports, with Boxing or Golf; quiz games; war games; word games; games based on dates; and miscellaneous games like Zoop, Bull and Life.

Overall, nearly all of the games are computer simulations of simple popular games familar to most people, with much reliance on the computer's random number generating ability to make them interesting. As the preface says 'very few of the games begin to use the full logical and computational capabilities of the computer to come up with something new and truely unique'. Some that do are Stars, Rocket and Life-2. Instead the computer is used to take care of messy details to make the game much more enjoyable and to improve presentation. The speed of play is also increased.

For those computer hackers interested in games this book has to be a must. There's already a copy in my bookcase and I am still waiting for a BASIC compiler for my system. The review copy was loaned to us by the Sales Dept., Digital Equipment Australia Pty. Ltd., PO Box 491, Crows Nest.

– K.B.

PRODUCT REPORT

THIS MONTH IN PRODUCT REPORT WE LOOK AT THE IMSAI 8080 MICROCOMPUTER.

Released in the U.S. in 1975 the IMSAI reached Australia in late 76. With the increasing popularity of this type of personal computer in Australia we thought it was about time to have a closer look at the IMSAI 8080.

Well, first of all what is it? Simply stated it is a microcomputer **system** built around Intel's popular microprocessor chip, the 8080. The word to note is system since the IMSAI has provision for expansion beyond the three main pc boards required for the basic microcomputer. To keep the purchase price down the IMSAI is also available as a kit of parts to be put together by the buyer.

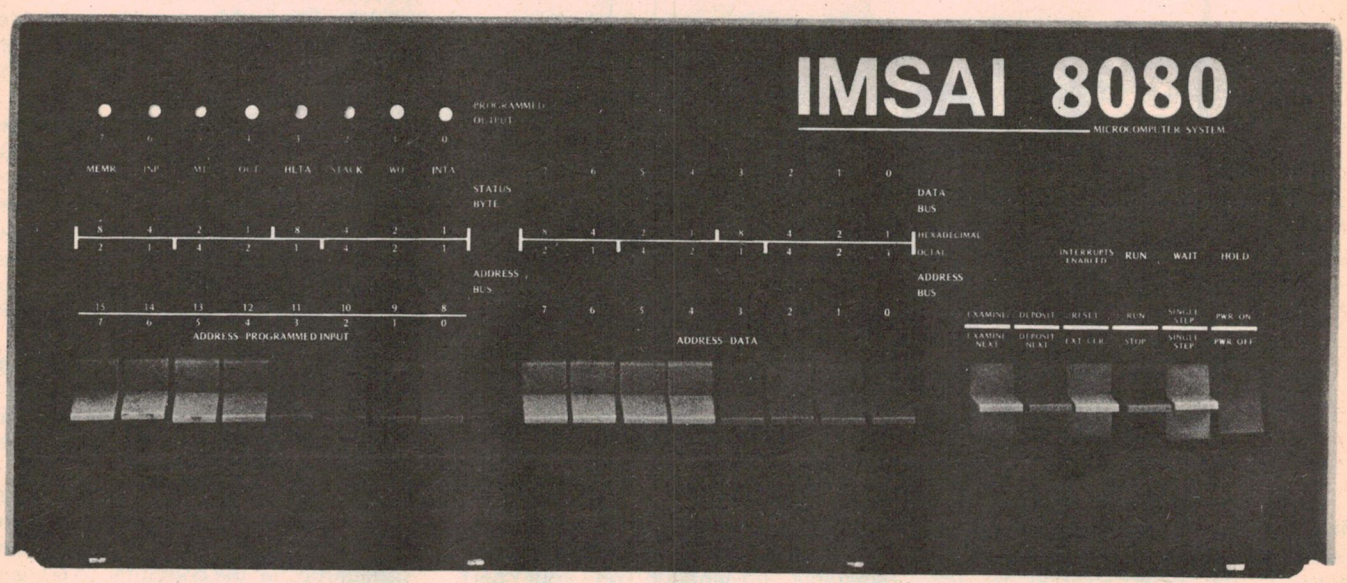
Bus and is now refered to as the S100 bus. Many other manufacturers are now offering their products using this bus; this allows their products to be plugged into and used on the IMSAI 8080. For example, Processor Technology have a Video Display Module that works nicely on the IMSAI.

To get the minimum IMSAI microcomputer going you need what is known as the 'basic system' and at least one RAM board. The basic system consists of the front panel and control board (CP-A), the microprocessor board (MPU-A), the power supply and the metal work that makes up the case and card cage. As well there is the very important system software, and the documentation for both the hardware and software.

set up addresses and data while the LEDs display the current add esses and data values. The high order address switch is also an input port that can be read under program control, while the top left hand row of LEDs is an output port for outputting data under program control.

The switches on the right hand side are the control switches. They are used to EXAMINE memory, load into memory (DEPOSIT), to RESET the system, to HALT or stop executing the program, and to RUN or continue executing instructions. The single step feature lets the operator execute one instruction at a time so he can debug his program.

The Power supply fits down the right hand side of the case. It is un-



With the expansion the user can tailor a system to suit his particular needs. To help you do this IMSAI offer a range of plug-in boards for many applications. For example, the 4K RAM and ROM boards, the SIO2 Serial I/O Interface and the PIO4 Parallel I/O board, the UCRI-1 Universal Tape Cassette Recorder interface and the GP-88 General purpose prototype board.

IMSAI also have a range of Peripheral devices and matching interfaces.

When discussing the system ability it should be pointed out that the IMSAI uses what used to be called the Altair

The MPU-A processor board is designed around an 8080A, with an 8224 clock driver chip crystal controlled at 18 MHz to give a machine cycle time of 0.5 microseconds. The processor board is buffered with full capability to drive the bus.

The Front Control Panel (CP-A) is shown in the photo. This board is the operator's console. From this panel the operator loads programs into memory and examines what is already there. He can also control whether the microcomputer is in the RUN, HALT or SINGLE STEP mode.

The front panel switches are used to

regulated and comes out with ± 16 volts at 3 amps and +8 volts at 28 amps. Each pc board has its own three-terminal regulator, so with a card cage accepting up to 22 cards this allows approx. 1.3 amps at 5 volts per board. To keep things cool there is an exhaust fan fitted to the right hand rear wall.

The case is a U shaped box some 49.50 mm (19½ inches) wide, 178 mm high and 432 mm deep. The case top, also U shaped, is painted a light blue that contrasts nicely with the red LEDs and paddle switches. The case also contains the mother board into which plug the remaining pc boards. The basic

system comes with a six slot mother board and two connectors.

Supplied with the basic IMSAI is the system software. This consists of a monitor or executive program that will manipulate files in RAM, a line-oriented editor and an assembler program. Since the system software has to be reloaded each time the power is turned on, a short loader program is also supplied.

In operation this short loader is entered via the front panel switches, then, in turn the loader program is used to input the system program. The system software is supplied on paper tape and is fully documented with complete mnemonic listings.

Note however the system software does require at least 8K of RAM to work in, so you have to buy extra memory, as well as a paper tape reader before you can run it.

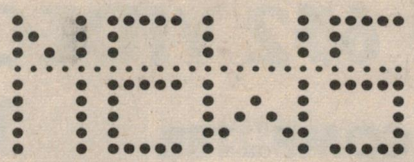
Documentation includes a three inch thick three ring binder holding the User's Manual, a copy of Intel's 8080 Microcomputer System User's Manual and a copy of 'An Introduction to Microcomputers' Vol. 1.

Assembly instructions for the IMSAI are in the User's Manual as well as details on each of the pc boards. Instructions in the manual seemed quite detailed, and in the back there is a complete set of schematic diagrams and system software listings.

The Intel 8080 manual contains a complete run down on the workings of the 8080 microprocessor chip as well as an explanation of the 8080 instruction set.

The 'Introduction to Microcomputer' Vol. 1 will be especially valuable to those just starting on microcomputers.

The IMSAI examined in the report came from Automation-Statham Pty. Ltd., 47 Birch St., Bankstown, who import and sell IMSAI equipment in Australia. Automation-Statham maintain a demonstration IMSAI system complete with floppy disks and line printer at their Bankstown offices and offer a Saturday morning assembler service for their customers who lack the necessary peripherals of their own. ●



Any SA microcomputer clubs yet?

I am interested in joining any microcomputer club formed in South Australia. I have experience in programming in FORTRAN, BASIC and on programmable calculators. I am more interested in software than hardware though I do maintain an active interest in electrical engineering.

A.B.M., Clarence Gardens, SA.

In answer to S.E. of Newcastle, I would like to point out that standards already do exist for cassette storage. The so-called Kansas City Standard. This has become the hobbyists' standard in the U.S. and is a simple and reliable one to use.

I am most interested in meeting with other computer freaks in the Latrobe valley or occasionally in Melbourne. I know of no clubs in Victoria yet but am interested in find one.

Thanks for the excellent feature. Keep it up.

P.L., Traralgon, VIC.

Are there any computer clubs who want new members. A.B.M.'s and P.L.'s letters are typical of several Printout has received and we would be glad to pass on details of your club to these enthusiasts. —

Editor.

WA Computer Club

Firstly, congratulations on the high standard of Printout, hopefully it will become a separate magazine in its own right.

Given enough interest I hope to start a microcomputer club in Perth. Could you assist me by publishing details of this in Printout?

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SOFTWARE LIBRARY

The best thing to feed a computer on is software. It makes it healthy, tones up the memory cells and gives the front panel LED's something to blink about. But software, being a rare commodity, is often hard to obtain. For users of the Motorola 6800 this problem has been reduced with the formation of the Australian 6800 User Library.

The library aims to provide a central distributing point for programs written in 6800 machine code, and make these programs available to 6800 users. This means the user will not have to reinvent the wheel should the program already exist in the library.

Although just beginning, the library already has a number of programs ranging from simple subroutines to 32 bit floating point maths packages. Also included are memory and instruction test programs.

To encourage authors to submit software to the library, a royalty on each sale is paid to the author. The royalty is currently a handsome 50%. The types of programs wanted are games and demonstrations, fast floating point packages and FORTRAN subroutines.

Inquiries about user group software should be directed to: Creative Strategies Pty. Ltd., P.O. Box 101W, Neutral Bay, NSW 2089.

• • •

TAKE A NYBBLE OR TWO

A new word that has been appearing a lot lately is Nybble. It's being used to represent 4 bit binary words. Does this mean there are two Nybbles to a Byte?

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Build this exciting project described in the February issue of ETI. We are proud to have worked with the ETI team in developing this VDU as we feel it represents a major breakthrough for the home hobbyist. The modular construction means easier assembly and trouble-shooting and at the same time offers maximum flexibility. The 632 can be readily modified to operate from an 8 BIT MICROPROCESSOR BUSS and can be adapted to display graphics on any black and white TV or colour TV set.
The following modules have been published and are available now. As soon as further modules are described in ETI we will release them. An attractive case (with plenty of room for system expansion!) and a comprehensive workshop manual will be available shortly..

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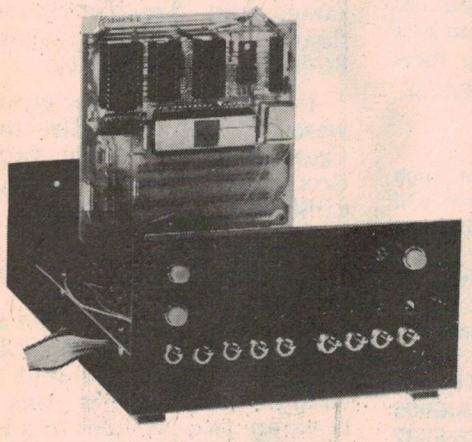
2. Please allow $2.50 for post and packaging and certified mail. This will be sufficient cover for one or more kits ordered at the same time.

SCMPIO: LOW COST I/O FOR SC/MP



SCMPIO KIT $49.50 Plus $2.50 Post, Pack & Insurance

SC/MP with SCMPIO $139.50 Plus 3.50 Post, Pack & Insurance

The SCMPIO kit now provides SC/MP Introkit users with a low cost input/output capability. This is a great kit if you don't have ready access to a Teletype. It is an ideal teaching aid, learning and development tool for hobbyists, professors, students and electronic entrepreneurs at all levels.
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SCMPIO consists of a mother board which accepts the SC/MP PCB socket and interfaces with a user access front panel. Data can be entered via front panel toggle switches and output is displayed using LEDS. Additional controls include CPU RESET, SINGLE STEP OR CONTINUOUS OPERATION, CHARACTER STROBE, RUN. Using these facilities it is an easy matter to execute programs, to examine or modify the contents of memory and the SC/MP registers and to monitor program performance.
SCMPIO can be readily expanded if required. Provision has been made to fit an additional 72 way PCB socket (for extra RAM cards etc) and external voltage regulators if required. A HEX or ASCII encoded keyboard can be easily fitted (the ETI631 encoder is ideal). The output can be read into other modules including the ETI630 ASCII – HEX display and the ETI 632 VDU.
The SCMPIO kit is supplied with all components, fibreglass PCB, prepunched metalwork, hardware, solder and full assembly instructions. Also included is our own exclusive handbook "A beginners guide to programming SC/MP" together with sample programs for you to run.

See ETI January Issue PAGE 91 for full product review.

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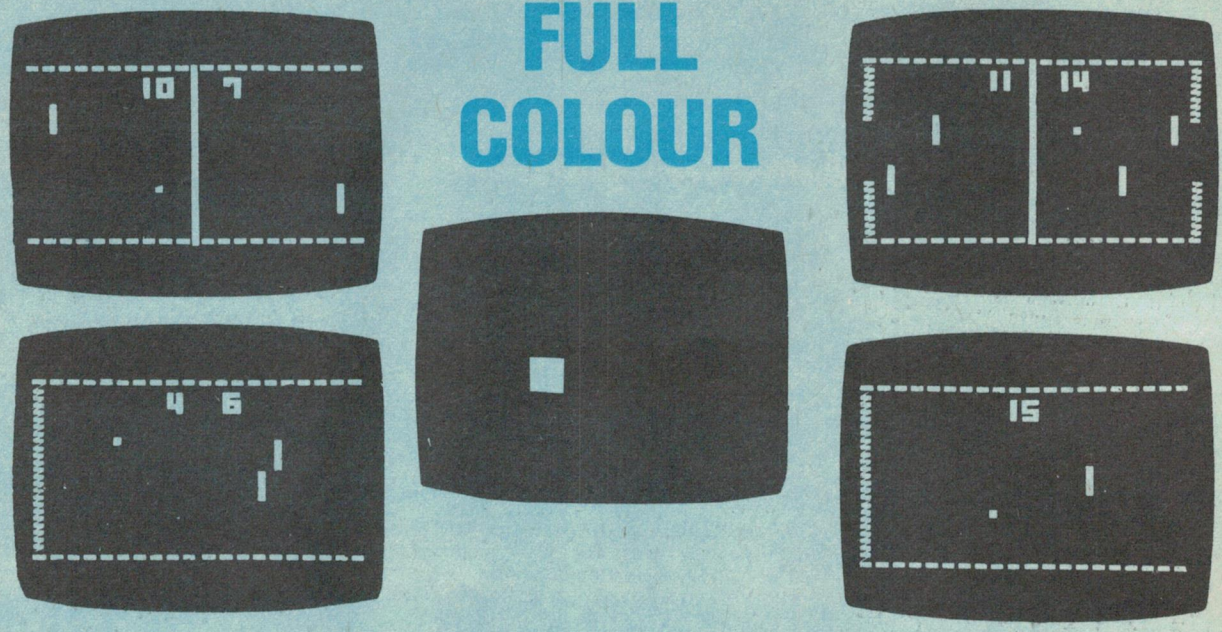

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VIDEO DISPLAY UNIT

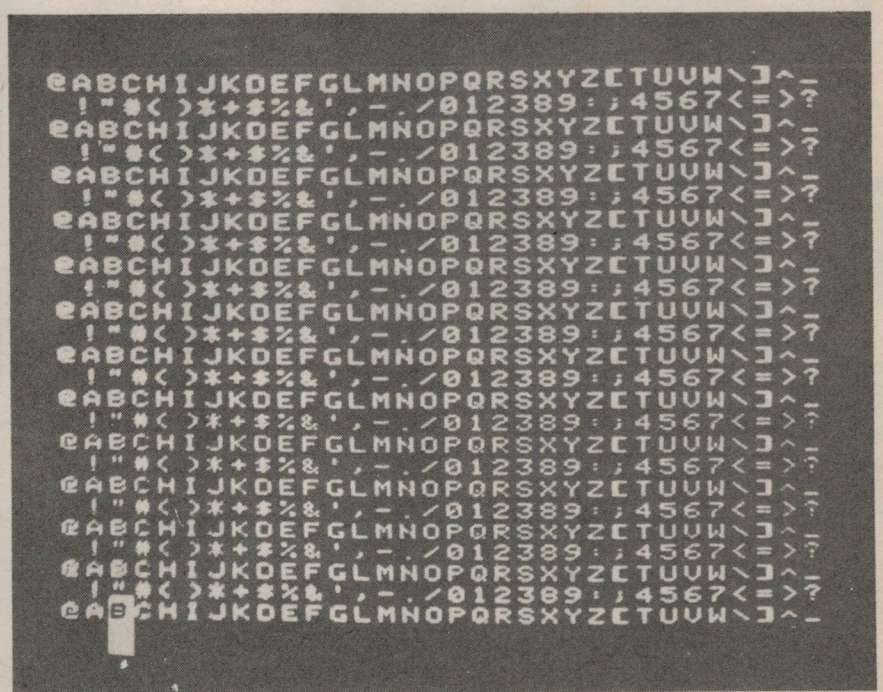
COMPUTER TERMINAL PROJECTS

This economical VDU is designed for use with a microcomputer. It combines with the ETI 631 keyboard to make a versatile terminal.

THIS IS THE SECOND ARTICLE giving constructional details for the ETI 632 VDU project. Last month we dealt with three of the boards in the project – the video sync board, the power supply board and the memory board. This article looks at two more sections of the VDU: the character generation circuits and the control logic.

The character generator is built on one pcb, ETI 632C, and the control logic is built on two boards, ETI 632A and ETI 632B. We intended to build the control logic on one board but we found that there were too many input and output connections needed and the necessary socket would be too big for our mother board.

We suggest you build up the character generator board first and test this by connecting it up to the video sync board. You should get a pattern on your TV like the one shown on the right. When the control logic is built you can connect up the six boards and the keyboard (any parallel ASCII type, like the ETI 632) to give you a TV typewriter – you can write onto your TV screen. Next month we will finalise the design by publishing the mother board for the VDU and serial I/O using a UART (ETI 633), and we will give full details of specifications, how to use the terminal, and pictures of what the terminal can do with a simple evaluation kit computer.



A display like this verifies that the character generator board is working. The cursor, at the bottom left hand corner of the screen, does not appear until the full VDU is built up.

VIDEO DISPLAY UNIT

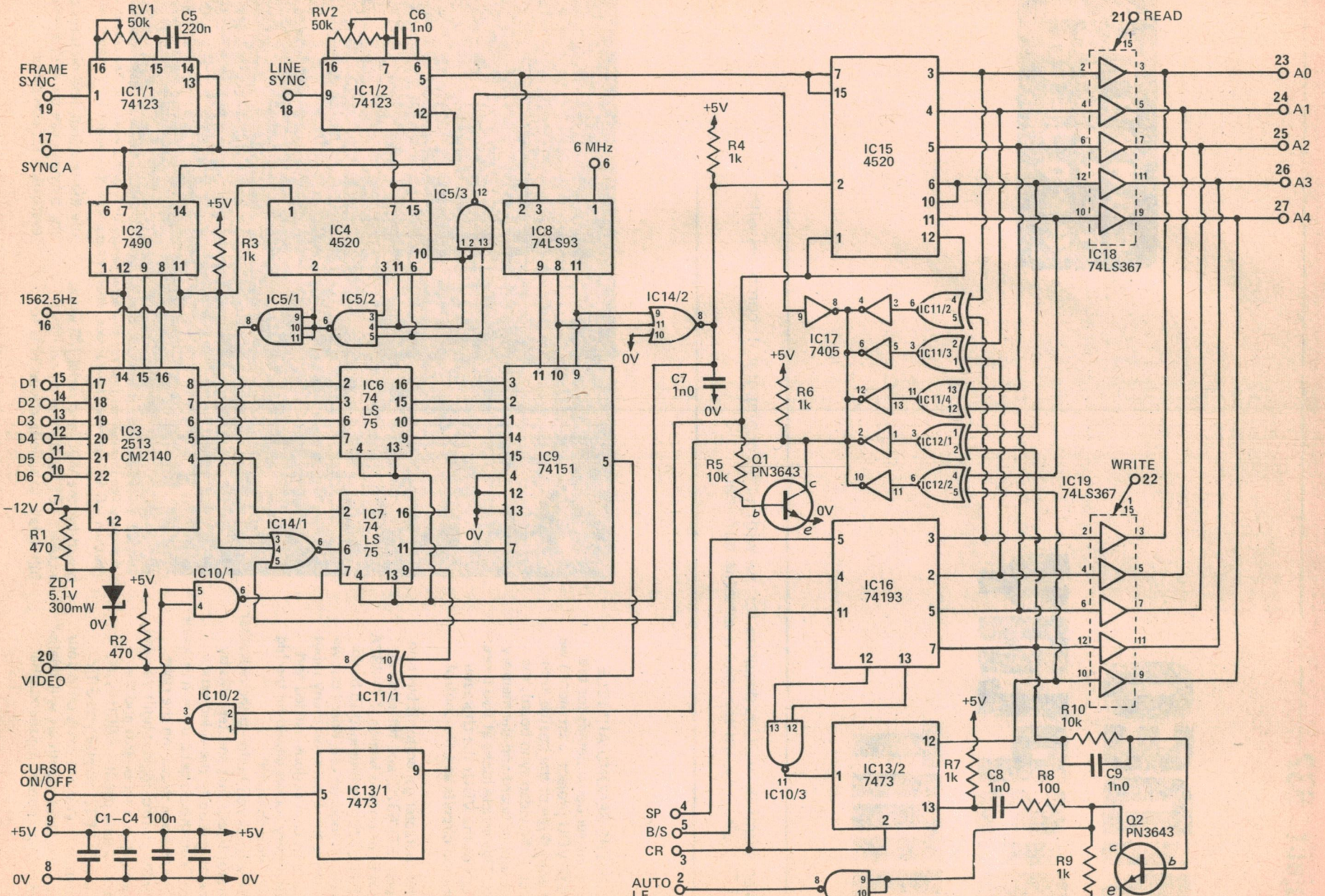


Fig. 1. Circuit diagram of the character generator board ETI 632C

How It Works

General

To display the information in the memory on the TV screen the VDU has to provide a serial stream of bits in the correct format. We have a maximum of 25 rows each of 32 characters on the screen, with an additional seven rows stored in the memory but not displayed.

Each of the rows of characters occupies 10 TV lines, three of which are always blank, giving the vertical space required between characters. Each character is drawn using a 5 x 7 dot matrix — seven lines of five dots. A space equivalent to three dots is always left blank to give the horizontal space between characters. So the 5 x 7 "active" matrix is located in an 8 dot x 10 dot area on the screen.

To generate the characters we use a ROM (read only memory) which can give any of 64 characters in this format.

Assume we have a memory, into which we have written data to be displayed. We start scanning the TV screen from the top left corner with a frame sync pulse (negative pulse 300 μs wide). The next 30 or so lines are blank with only line sync pulses (negative, 5 μs wide, every 64 μs), then on the next line, after about 10 μs, the top line of the first character is selected by the memory. The five data bits emerging in parallel from the character generator are then serialised, and added to the video signal (where a positive pulse gives a white spot on the screen). The serializing is done at a 6 MHz rate, therefore it takes only 1.33 μs to complete the cycle. Then the second character is selected and so on.

The 32 characters in each line can be fitted between the line sync pulses and on the next pulse the second line, first character, is selected and the procedure repeated.

After ten TV lines the 33rd-64th characters are selected and displayed, and so on. After twentyfive rows of characters have been displayed the screen is blanked until the next frame pulse (all the above occurs within the 20 ms between frame pulses) when the cycle is started again.

To write into the memory it is simply a matter of changing the address from the control of the read cycle to the location to be written into. We take the read-write control of the memory low and at the same time supply the data line with the data required. After 1 μs the data, memory low and the address can be changed back to the control of the read cycle. This normally appears as a series of small dots on the screen only one or two characters wide and only one line high. Synchronisation could have been made with the line sync pulse. We didn't consider this necessary — there is no annoying effect.

In detail

As there are a number of pc boards involved and because each has its own numbering system we will suffix all components with the following letters:

A	components on		ETI 632 A
B	"	"	ETI 632 B
C	"	"	ETI 632 C
M	"	"	ETI 632 M
V	"	"	ETI 633

The character generator ROM (IC3C) is organised to decode any of the 64 characters to give five dots out in parallel — but the row (one of seven) has to be selected with a 3 bit code. This is done by IC2C which is a decimal counter (÷ 10) clocked such that a new row is selected every line sync pulse.

It is held reset (to 9) for about 2 ms (set by IC1/1 C) every frame sync pulse ensuring it always starts on the correct line. The five line outputs from the 2513 are latched by IC6 and IC7C to give more time for the memory and ROM to select and settle on a new character in the short time allowed (1.33 μs).

The serialising is done by IC8 and IC9C with IC8 being connected as a ÷ 8 counter and IC9 as an 8 bit multiplexer. The counter is clocked at 6 MHz giving the 1.33 μs cycle time and IC9 selects the eight inputs, three of which are connected to 0 V, in sequence. The outputs from IC8 are decoded by IC14/2C to give an output for 000 and 001 (decimal 0, 1) and this output is used to clock IC15C and also controls the latches.

IC15C is a CMOS 8 bit binary counter and is used to select the character that is displayed in the line. It is reset by the line sync pulse and stops when it has counted 32 pulses due to the 2^6 output being connected to the enable input (pin 12 to pin 1). The vertical selection of characters is done by IC4B and IC5/2B which is connected as a 5 bit binary counter. It is clocked by an output from IC2C which is one tenth of the line frequency. Therefore a combination of these two counters can select up to 1024 locations in the memory. The vertical counters are reset every frame sync pulse to ensure it always starts in the correct place.

Blanking of the display is done on all four sides. It is controlled by disabling the multiplexer IC9C by a high level input to IC14/1C. Top blanking and interline blanking is done by the "D" output of IC2C being taken high. Left margin blanking occurs when the counter IC8C is stopped. Right margin is handled similarly by IC15C and lower blanking by IC4C.

IC4 is a binary counter, clocked every character line and lines 24 and 25 are decoded. Counting is inhibited after 25 lines by the connection back to pin 2.

We have looked so far at the reading side of the display. We must also be able to write into the memory. The memory write address comes from IC16C and IC13/2C (which identify the vertical column) and IC3B and IC5/1B (which select the horizontal row) . The counters are also 5 bit binary (up to 32), similar to the read selectors but in addition they are reversible. This is necessary as we have both space and back space functions along with roll up (line feed) and roll down. The counters are controlled by these particular inputs and can also be reset back to zero to give a starting point.

When it comes time to write into the memory the address lines must be switched from the read selector to the write selector. This is done using tristate buffers on the outputs of the selectors. Tristate buffers have a control line input which if high causes the output to be in a high impedance state. This allows another control without causing high currents.

It is also necessary to simultaneously pull the read/write input of the memory low and place onto the data line the information to be written into the memory. All this takes just over 1 μs.

The outputs from the keyboard or the UART are connected to control card A. When the strobe (or data available) goes high IC5/1A is triggered and generates a 3 μs wide pulse. If the output from the keyboard is a legal character (the keyboard can output 128 codes but the

VIDEO DISPLAY UNIT

ROM can only decode 64 of them) the pulse is coupled to the read and write lines. Normally the read line is "0" and the write is a "1". And vice-versa during the write cycle. A second monostable IC5/2A resets the UART, telling it the data has been recovered. The illegal characters occur when the b6 and b7 outputs are either 1,1 or 0,0. These are decoded by IC1/1,2,3A and IC2/1A and can disable the write pulse, if needed. Some control functions, namely carriage return, line feed and back space, are decoded by IC1/1A, IC3/1A, IC1/4A and IC4A and operate the appropriate functions.

On the initial setting up the total memory is cleared by changing the control to the memory to write and adding a blank (100 000) to the data bus, but without changing the address lines. As the complete memory is scanned by the read cycle in 1/50 sec, blanks are written into every location.

One other feature of the VDU is the cursor which tells you where you are on the row (i.e., on the bottom row on the screen). It is useful if you have to change anything on the screen and takes the form of a reversed colour character and a white bar going off the screen vertically. This is generated by comparing the read address to the write address and reversing the polarity of the video output during the generation of that character. IC11/2 – IC12/2C do the comparing along with IC17C, which also has the output of IC5/3C controlling it, and this controls IC11/1 via a few gates and the latch IC7C. The output can be disabled, if the

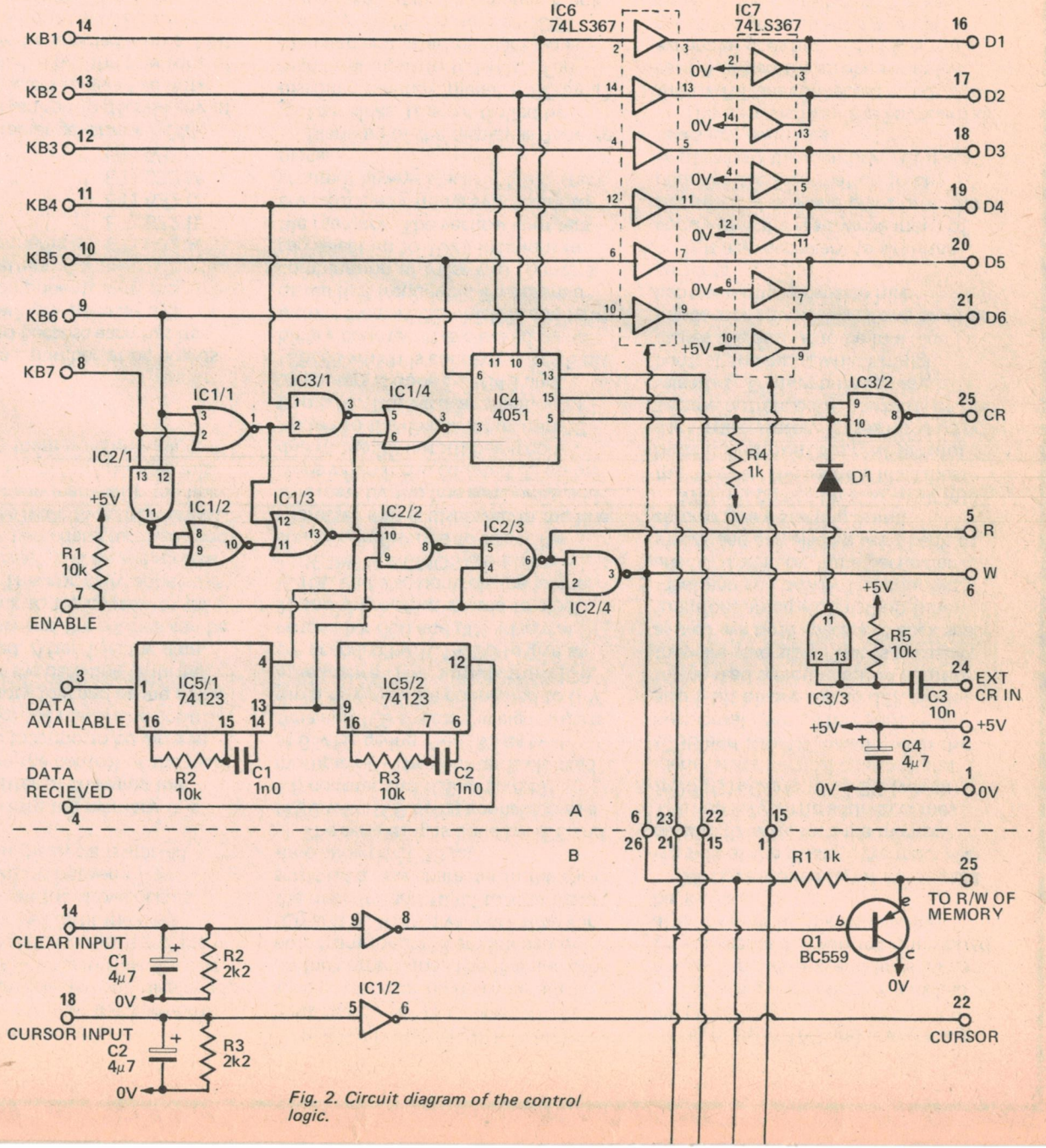
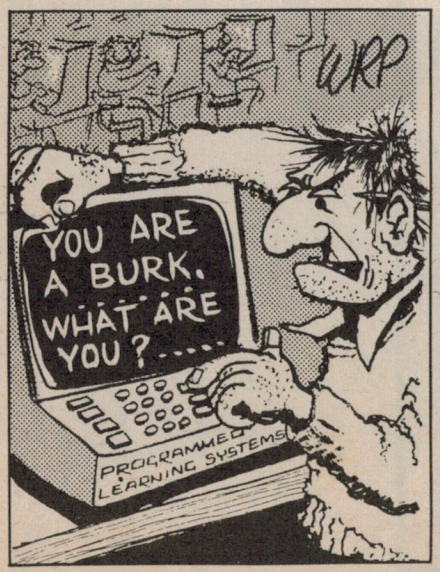
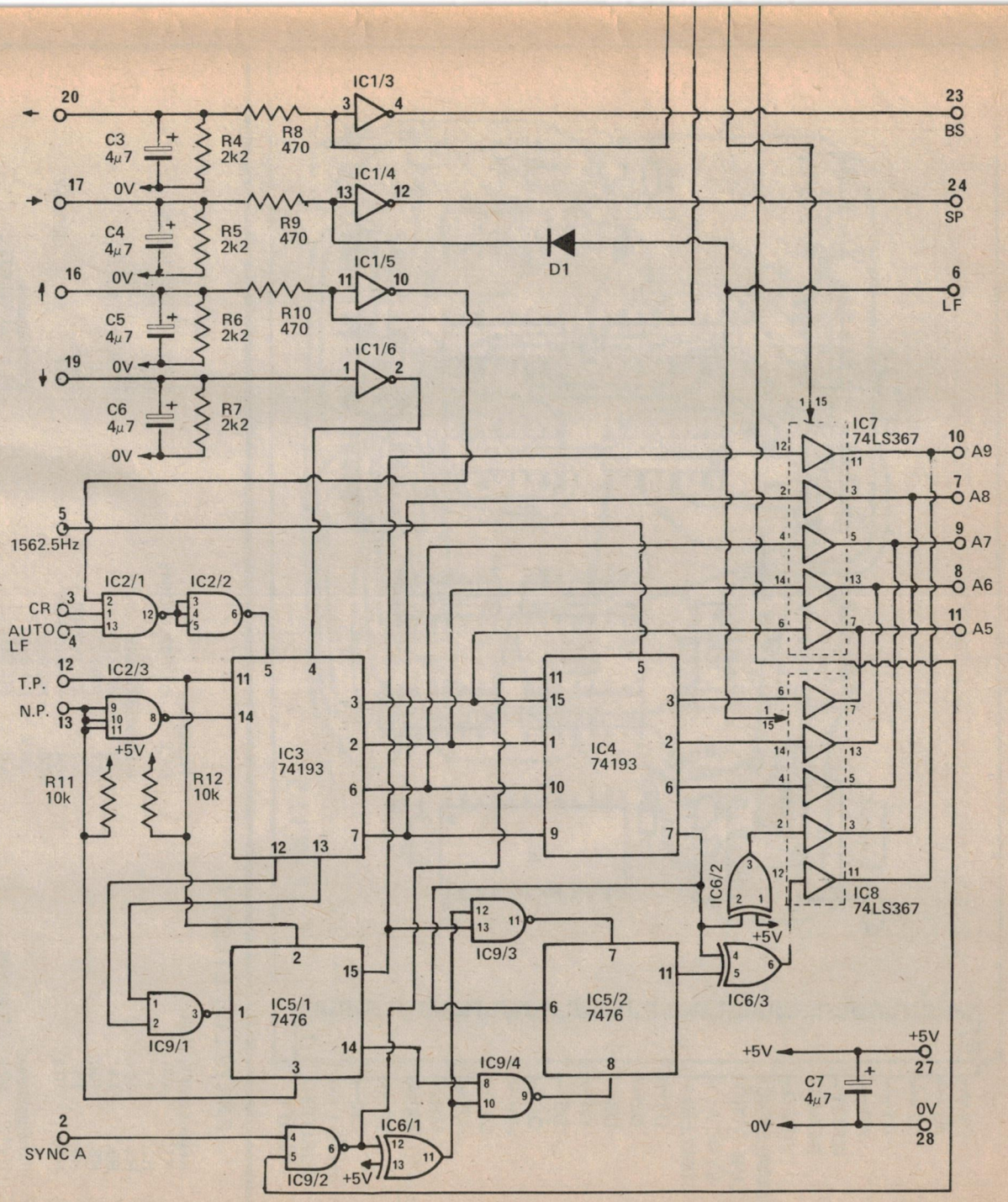


Fig. 2. Circuit diagram of the control logic.

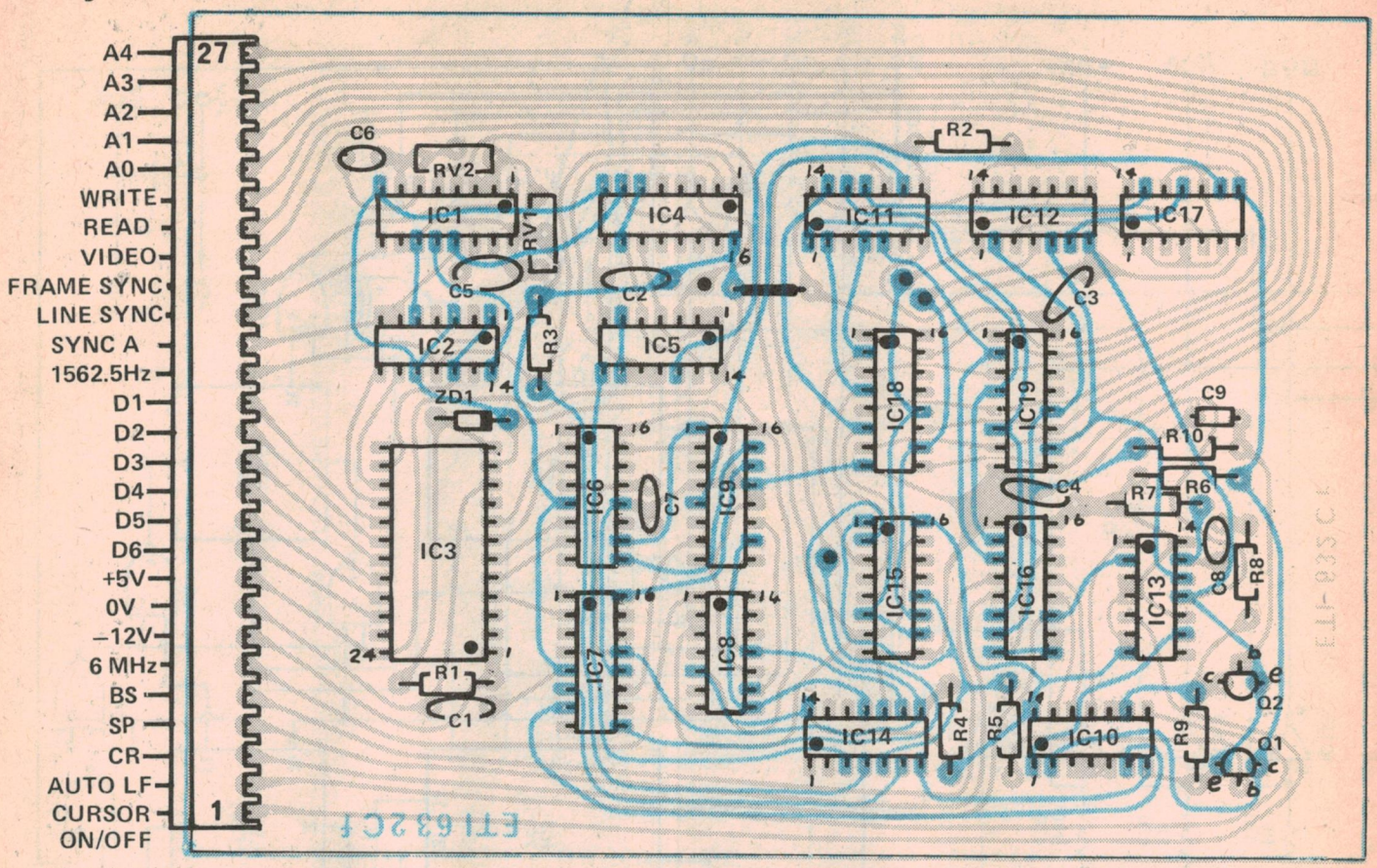
cursor is not required, by the output of the flip-flop, IC13/1C.

The vertical read/write control is slightly more complex than previously stated due to the scrolling of the rows. If reading starts at row 1 then writing must be done on row 25 or the bottom row of the screen. The write IC (IC3, 5/1B) is normally reset to "0" meaning that the first row is row 1. The frame pulse resets IC4 and IC5/2 to the same output as IC3 and IC5/1 but the output of it is modified by IC6/2 and IC6/3 such that 8 is added. This means that while writing is done on row 1, reading starts on row 9 (which with a limit of 32 lines is in fact 25 lines before it). When the write row is incremented the start position for the read cycle also changes accordingly. If the 'top of page' button is pressed the write counters are preset to "25" and reading therefore starts on row 1 moving the page up the screen until the first row previously written appears on the top of the screen.





Project 632



PARTS LIST ETI 632 C

Resistors all ½ W 5%

R1,2	470	
R3,4	1 k	
R5	10 k	
R6,7	1 k	
R8	100	
R9	1 k	
R10	10 k	

Potentiometers

RV1,2	50 k	trim type

Capacitors

C1-C4	100 n	disc
C5	220 n	polyester
C6-C9	1 no	polyester

Transistors

Q1,2	PN3643, 2N3643

Integrated Circuits

IC3	74123
IC2	7490
IC3	2513 C2140
IC4	4520 (CMOS)
IC5	74LS10
IC6,7	74LS75
IC8	74LS93
IC9	74151
IC10	74LS00
IC11,12	74LS86
IC13	7473
IC14	74LS27
IC15	4520 (CMOS)
IC16	74193
IC17	7405
IC18,19	74LS367

Diode

ZD1	5.1 V	300 mW

Miscellaneous

PC board ETI 632 C
one 24 pin socket
total of 27 pins of A2145 sockets

Note – to save power 74 – series ICs maybe replaced by 74LS – types.

Testing

A certain amount of testing can be done as the unit is assembled, making any faults easier to find.

(a) Check the video sync generator board as described last month then remove R14 from the circuit.

(b) Connect the character generation card 632C to the video board and power supply as detailed below:

6 MHz on video board
to pin 6 on 632C

FS on video board
to pin 19 on 632C

LS on video board
to pin 18 on 632C

Video in on video board
to pin 20 on 632C

+5 and 0 V to the power supply

(c) Leave out the 2513 ROM at the moment and switch on.

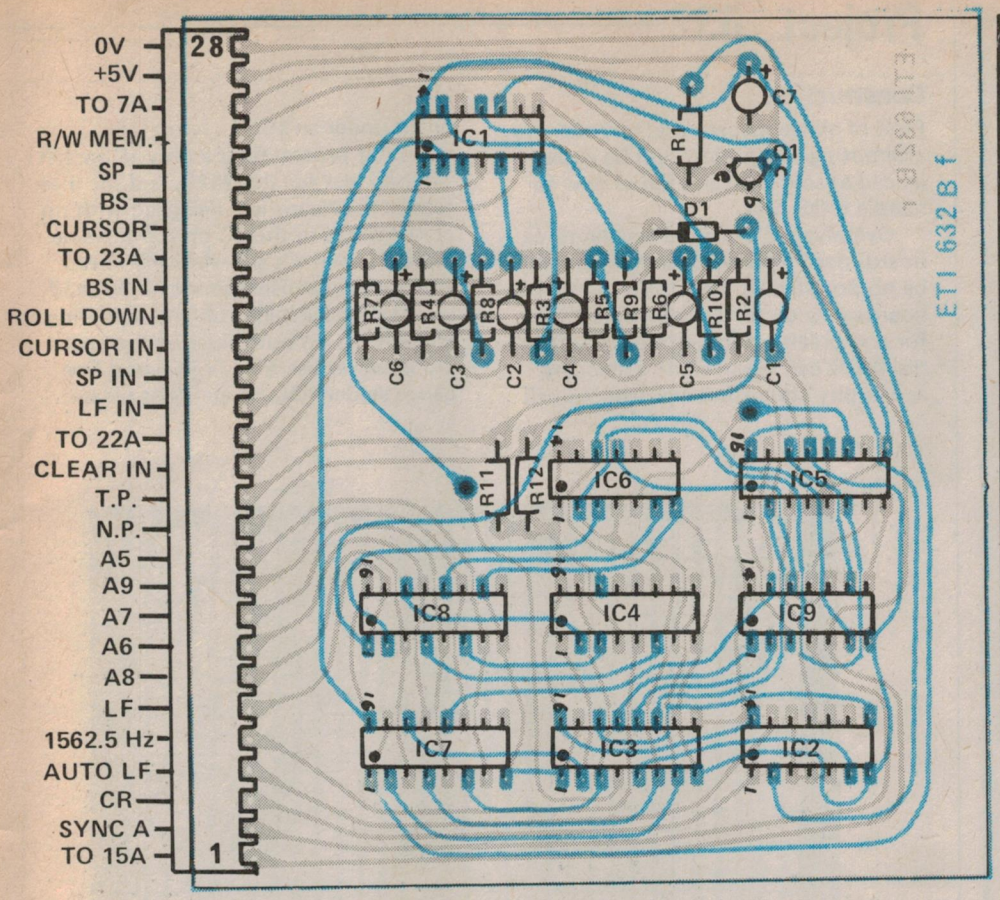
(d) On the screen should be a series of white squares, thirty two in a row and 25 rows. If so, proceed . . .

(e) Switch off and insert the ROM. Connect pins on the board as detailed below:

pin 15 to pin 23
pin 14 to pin 24
pin 13 to pin 25
pin 12 to pin 26
pin 11 to pin 27
pin 10 to test point A (between IC3 and 4)
pin 21 to 0 V

Switch on – the screen should now be full of characters – with all 64 characters in sequence repeated every two lines. See photo.

If all is still OK switch off, disconnect the above links and reconnect all boards as detailed in the construction.



PARTS LIST ETI 632 B

Resistors all ½ W 5%

R1	1 k
R2-R7	2k2
R8-R10	470
R11,12	10 k

Capacitors

C1-C7	4μ7 16 V electro

Transistor

Q1	BC558

Diode

D1	1N914

Integrated Circuits

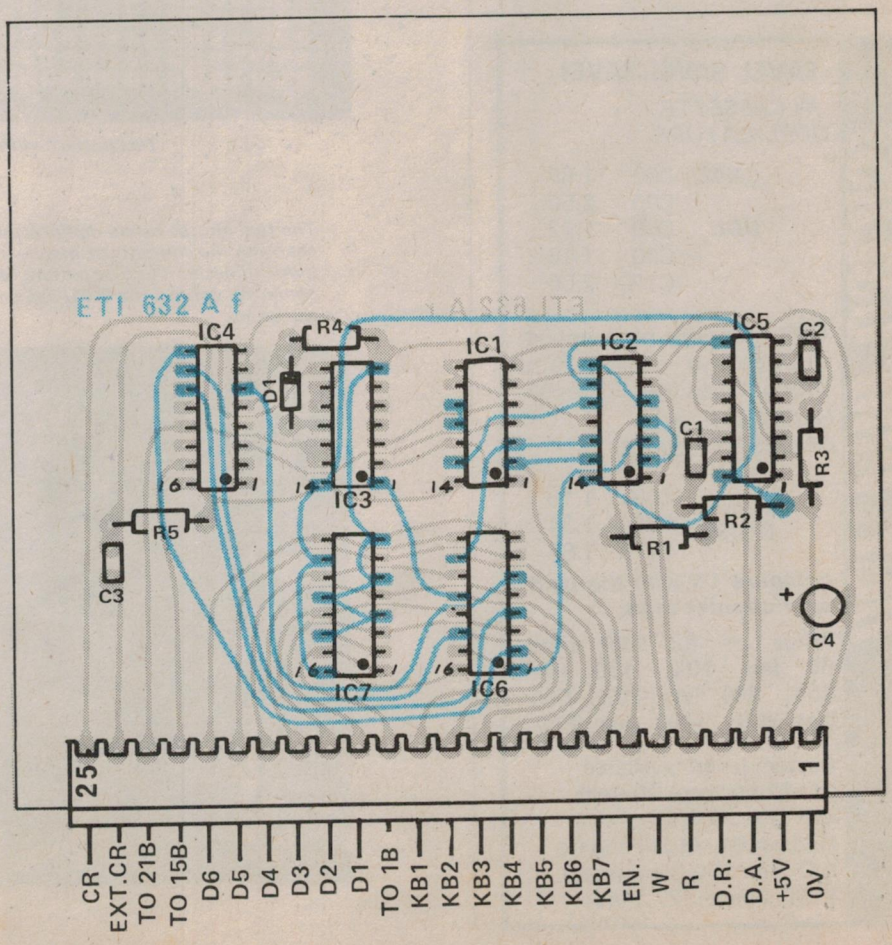
IC1	74LS14
IC2	7410
IC3,4	74193
IC5	7476
IC6	7486
IC7,8	74LS367
IC9	7400

Miscellaneous

PC board ETI 632 B
Total of 28 pins of A2145 sockets.

Note – to save power 74 – series ICs may be replaced by 74LS – types.

Fig. 3,4,5. Component overlays of the three pc boards.



PARTS LIST ETI 632 A

Resistors all ½ W 5%

R1-R3	10 k
R4	1 k
R5	10 k

Capacitors

C1,2	1 n0	polyester
C3	10 n	polyester
C4	4 μ7 16 V	electro

Diode

D1	1N914

Integrated Circuits

IC1	7402
IC2,3	74LS00
IC4	74123
IC5,6	74LS367
IC7	4051 (CMOS)

Miscellaneous

PC board ETI 632 A
Total of 25 pins of A2145 sockets.
Note – To save power 74 – series ICs. may be replaced with 74LS – types.

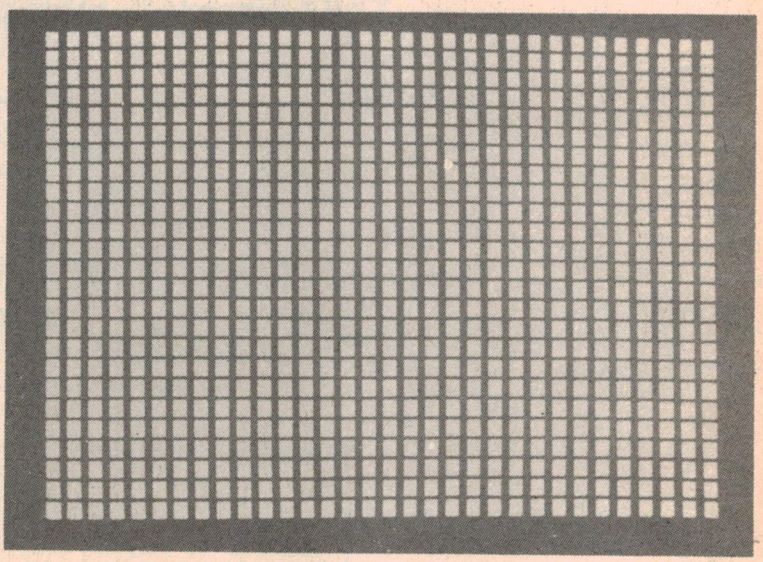
Project 632

Construction

First of all we assume that anyone attempting this project will be experienced at soldering and know how to handle MOS ICs!

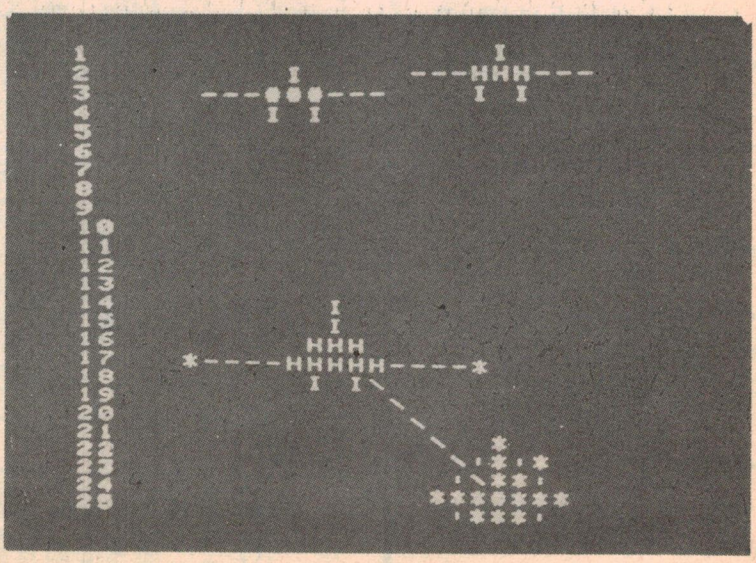
Overlays are provided for the three boards described and assembly should be no problem. It pays to examine the boards very carefully before assembly for any breaks or joined tracks as later discovery can be difficult, especially as Murphy states that any trouble will occur under an IC.

In our prototype the only IC socket we used was for the 2513, and for that reason the board was designed with no connections to this IC on the top side. All the other ICs are relatively cheap (the most expensive about $2.50) and we rarely have had problems soldering to such ICs on both sides of the board. Do however use a small iron and fine gauge solder! (No scope irons please).



Test pattern with the ROM removed.

The two photos below demonstrate two features of the VDU: (1) Without changing the contents of the memory the rows can be scrolled – the seven hidden lines on the first picture become visible on the second. (2) Under computer control the VDU can be used to generate simple graphics for games, etc.



they can be checked out in sequence as detailed in the testing procedure. We will be publishing a motherboard next month, along with the UART, but for those who must get the VDU operational (it will work as a TV typewriter) all the interconnections are given. It is still recommended that the boards be tested in sequence as detailed elsewhere.

If you intend to use another construction method for the boards (eg, wire wrap) note that power rails and a lot of the pins connected to +5 V or 0 V are not shown on the circuit diagram. Therefore it is recommended that for pins not shown on the circuit diagram that the PC layouts be checked to see where, if anywhere, they are connected.

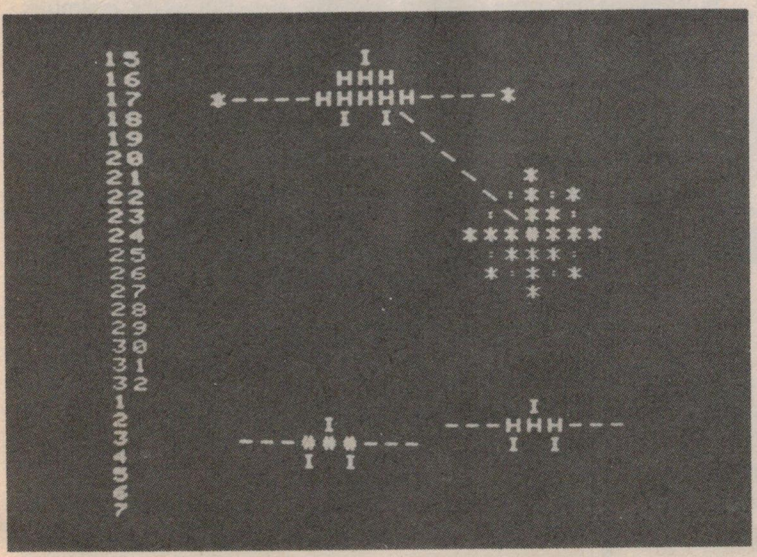
Interconnections
V = Video card
M = Memory card
C = 632C card
B = 632B card
A = 632A card

V1 – C6
V6 – C19
V9 – C18
V10 – C20
M5 – C10 – A21
M6 – C11 – A20
M7 – C12 – A19
M8 – C13 – A18
M9 – C14 – A17
M10 – C15 – A16
M11 – B10
M12 – B7
M13 – B9
M14 – B8
M15 – B11
M16 – C27
M17 – C25
M18 – C26
M19 – C24
M20 – C23
C1 – B22
C2 – B3
C3 – B4 – A26
C4 – B24
C5 – B23
C16 – B5
C17 – B2
C21 – B6 – A5
C22 – B26 – A6
B1 – A15
B13 – A24
B15 – A23
B21 – A22
+5V – V11 – M21 – C8 – B27 – A2
0V – V12 – M1 – M22 – C7 – B28 – A1

External connections:
keyboard
b1 – KB1
b2 – KB3
b3 – KB3
b4 – KB4
b5 – KB5
b6 – KB6
b7 – KB7
STROBE – DATA AVAILABLE

Control panel
↑ B16 via Pushbutton to +5 V
↓ B19 via Pushbutton to +5V
→ B17 via Pushbutton to +5 V
← B20 via Pushbutton to +5 V
Cursor B18 via Pushbutton to +5 V
Clear B14 via Pushbutton to +5 V
** a 47 ohm resistor should be connected between +5 V rail and the pushbuttons to prevent capacitors C1-C6 (B) from upsetting the +5 V supply when the pushbuttons are pressed.*

New page B13 via pushbutton to 0 V
Top of page B12 via pushbutton to 0 V



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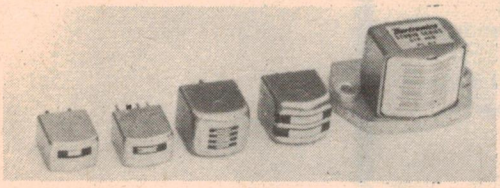

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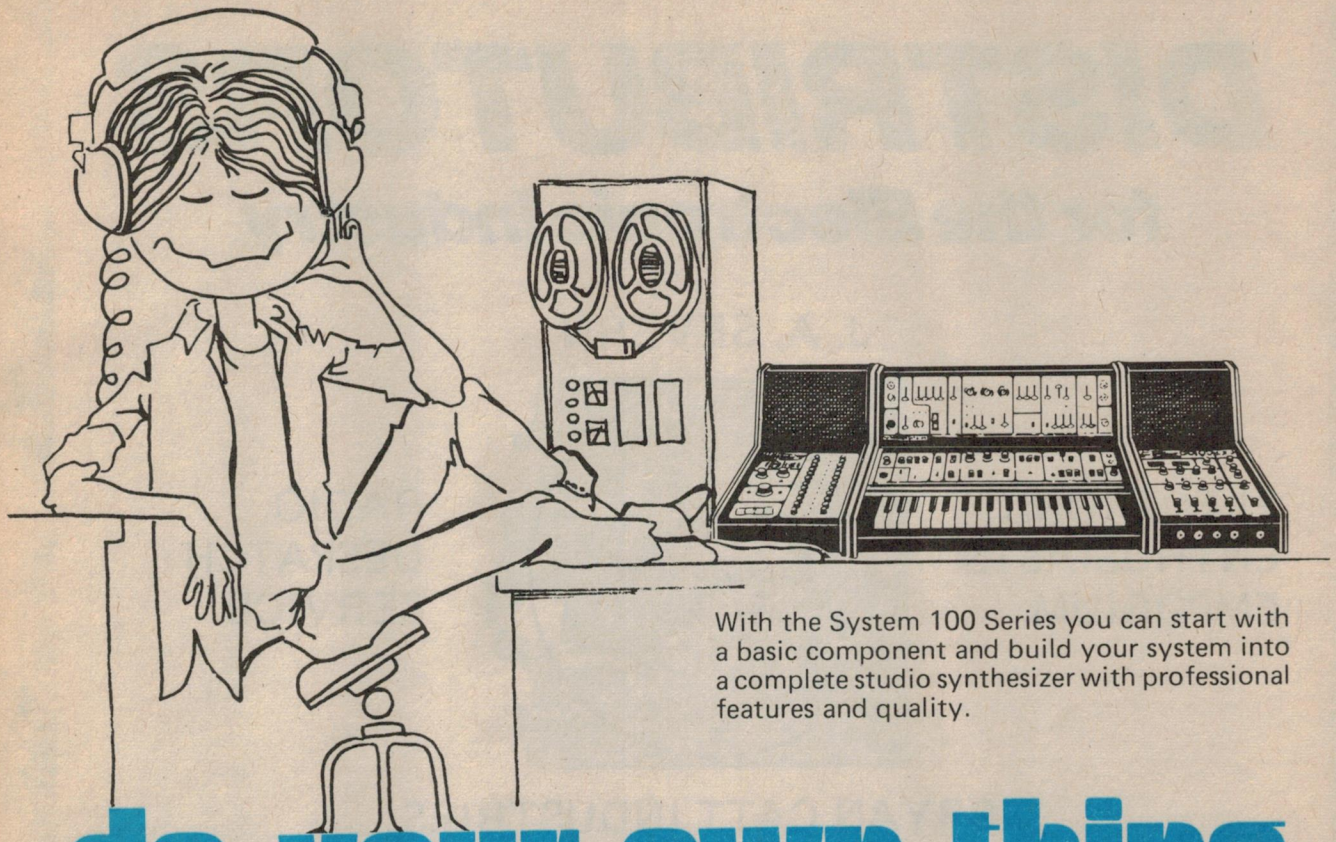

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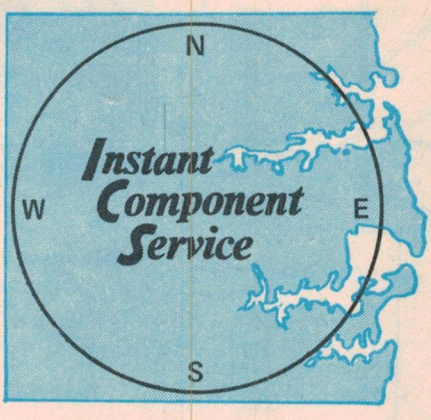

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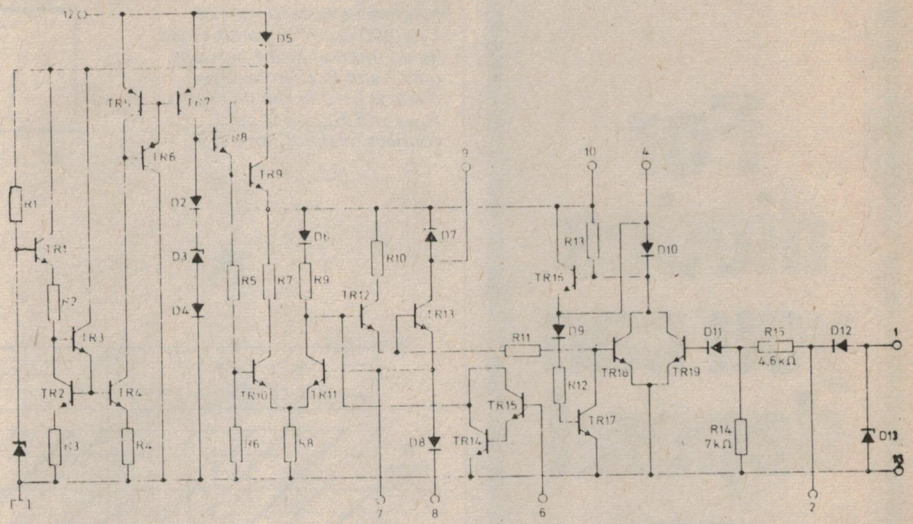
ETI data sheet

SAK140 Rev Counter IC

The SAK140 is a monolithic integrated circuit intended for use as a rev counter in motor cars.

It contains a stabilization circuit and a monostable multivibrator which converts the circuit input pulses into output current pulses of constant duration and amplitude. This pulse duration is determined by an external R-C network; by proper choice of R and C, the circuit can be easily adapted to any milli-ammeter. Together with the internal stabilization circuitry this makes the indication almost independent of temperature changes and supply voltage variations.



QUICK REFERENCE DATA

Supply voltage	V_P		10 to 18 V
Power dissipation at n = 6000 rpm; I_o = 12 mA; V_P = 12 V	P_{tot}	typ.	230 mW
Input pulse amplitude (pin 1)	V_i	>	3.5 V
Output current (pin 9)	I_o	<	50 mA

MAXIMUM RATINGS

Supply voltage (pin 12)	V_P	max.	18 V
Current at			
pin 9 (peak value)	$-I_{9M}$	max.	50 mA
pin 7 (peak value)	$-I_{9M}$	max.	50 mA
pin 8 (peak value)	$-I_{8M}$	max.	50 mA
pin 1	$\pm I_1$	max.	10 mA
Total power dissipation	see derating curve		

CHARACTERISTICS

Supply voltage range (pin 12)	V_P	10 to 18 V	
Supply current (on-state) at V_P = 12 V	I_{12}	typ.	5 mA
Power dissipation at n = 6000 rpm; I_o = 12 mA; V_P = 12 V	P_{tot}	typ.	130 mW
Voltage at pin 7 (on-state)	$V_{7\text{-}16}$	typ.	2.5 V
Temperature coefficient of output pulse (pin 9)		typ.	200 ppm/°C
Adjustable output current resistor between pins 7 and 16 or 8 and 16		<	50 mA
Resistor for peak output current adjustment	R_m	>	50 Ω
Resistor for output pulse duration adjustment	R	typ.	270 kΩ
		0.01 to	500 kΩ
Capacitor for output pulse adjustment	C	>	220 pF
		typ.	10 nF
		<	30 µF
Input pulse frequency	f	<	400 Hz
Input pulse frequency (pin 2 not connected)	f	<	30 kHz
Influence of supply voltage on output amplitude			
V_P from 10 to 16 V; Fig. 1		typ.	0.6%
Fig. 2		typ.	1.6%
Input triggering voltage at which level good triggering is achieved	$V_{1\text{-}16}$	>	3.5 V
		typ.	0.75 V
Duty cycle of output pulse	δ	<	0.90

NOTES:

The circuit is internally protected against reverse connected supply voltage.

To prevent the input circuit from overloading by large input pulses a voltage regulator diode (D13) has been connected at the input terminal.

This diode also functions as a protection against negative trigger pulses.

A resistor has to be connected in series with the input terminal, having such a value that the input current does not exceed 10 mA.

ETI data sheet

SAK140 Rev Counter IC

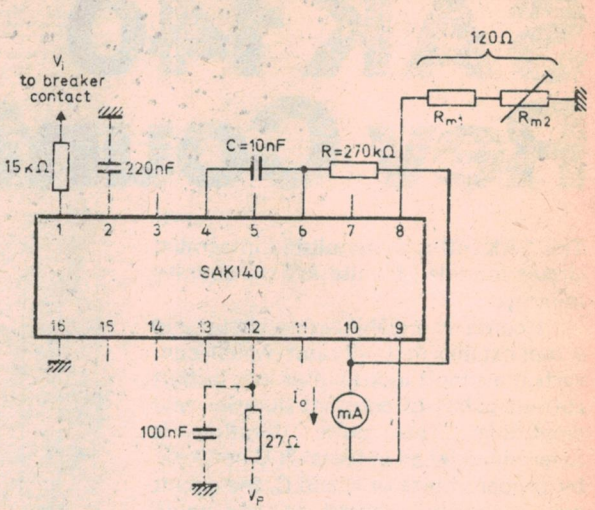
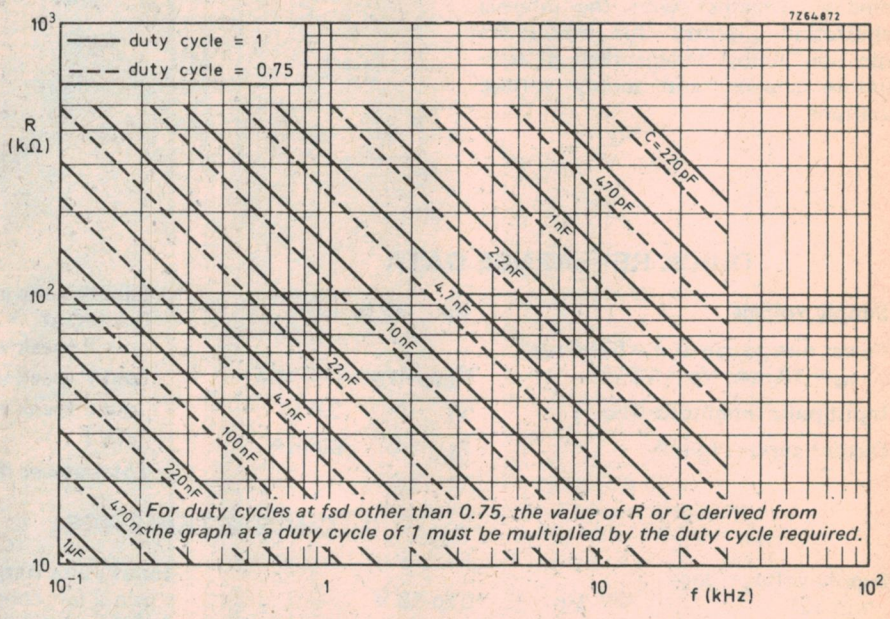
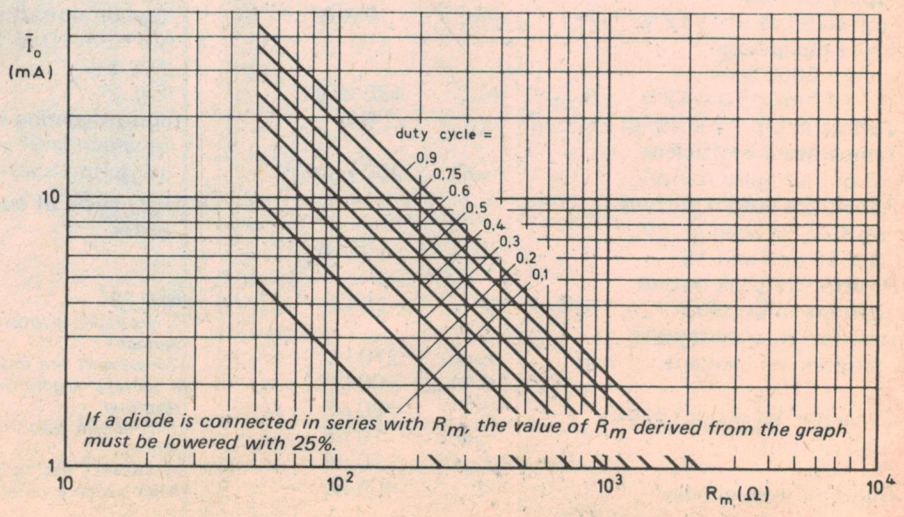


Fig. 2. In this circuit the temperature coefficient of I_O is 800 ppm/°C, determined by an internal diode between pins 7 and 8. If an external diode is used in the line from R_{m1} and R_{m2} it should connect to the IC on pin 7.





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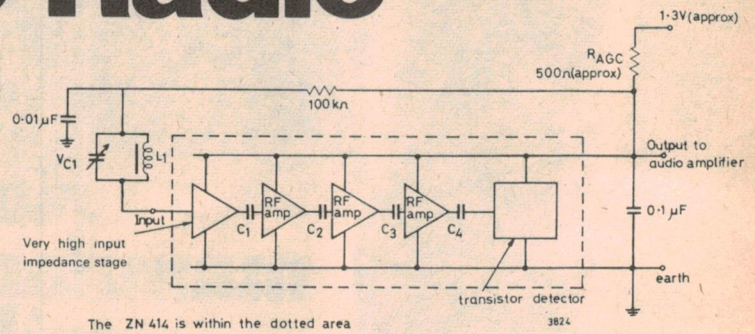
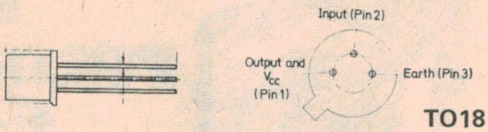
ETI data sheet

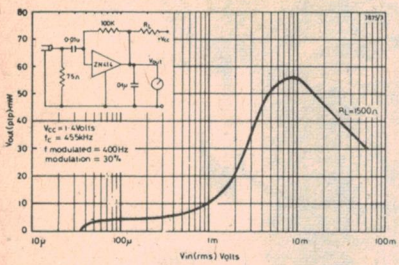
ZN414, IC Radio

A block diagram of the receiver is shown in Figure 1. Basically, the device is a ten transistor TRF tuner giving an audio output suitable for driving a reasonably sensitive amplifier. To obtain the higher selectivity needed in a TRF design, an extremely high input impedance is provided. The radio frequency signal is amplified successively using four stages of high stability. These are essential to ensure constant, reliable operation over a wide range of operating conditions. The amplified RF signal is then detected and used to derive agc action and finally, the audio component of the detected waveform is fed through a low pass filter to drive an external amplifier or earphone.

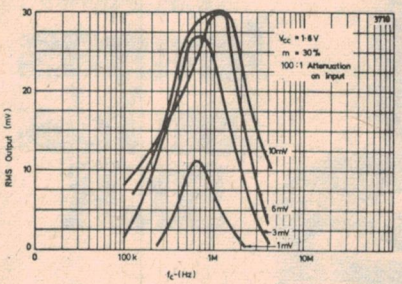




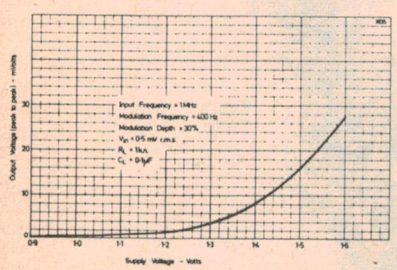
TO18 Package



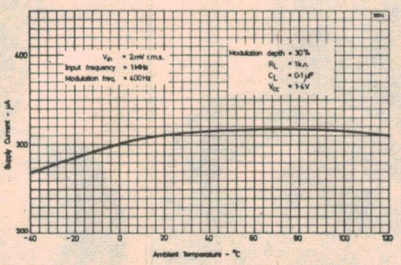
Graph 1. Gain Characteristics.



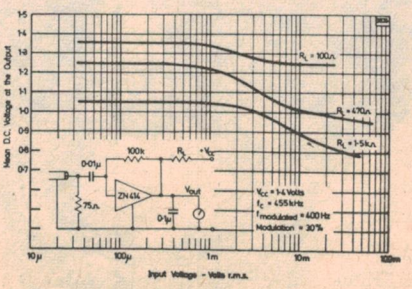
Graph 2. ZN414 Bandwidth Characteristics. The curve represents the usable frequency response of the ZN414 chip, and not the receiver bandwidth.



Graph 3. Gain Variation with Supply Voltage. This shows how the effective sensitivity of the ZN414 may be adjusted to suit the requirements of a particular application. For example, a miniature receiver, by definition, requires a smaller ferrite rod than usual. The input signal is correspondingly less. To compensate for this, the supply voltage can be increased, allowing the designer considerableflexibility. If taken too far, instability occurs and 1.6 volts is considered the normal upper limit. The maximum voltage change across R_{AGC} is about 200 mV, enabling the ZN414 with few other components, to drive into logic decoders for paging receiver applications.



Graph 4. D.C. Level Change at 2N414 Output.



Graph 5. Change in Supply Current with Temperature.

Aerial Circuitry

By far the most important requirement for obtaining a satisfactory performance from the ZN414 is that the tuning circuit should have a high 'Q'. Failure to adhere to this rule results in poor selectivity and loss of sensitivity.

The ferrite rod chosen should be of high quality, and for most applications should be with the size range 2" to 5" (5 cm to 12 cm) long.

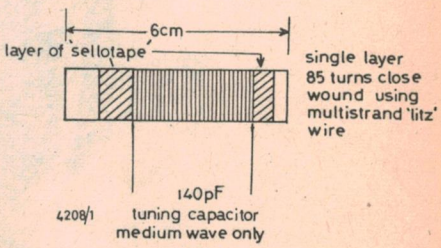


Fig. 2. Coil winding details

AGC

To obtain optimum results using the ZN414 it is important that the agc mechanism is understood. Signal strength, ferrite rod size and the 'Q' of the coil all affect the signal ultimately presented to the agc network. To compensate for these variables, the gain of the chip is variable, by varying the supply voltage (see graph 3). With the gain set too high, the agc circuit will swamp, causing strong stations to occupy large bandwidths.

If the gain is set too low, the signal-to-noise ratio worsens.

Electrical Parameters

Supply voltage range	Dependent on R_{AGC}; see graphs 3 and 4
Operating voltage on output pin	Variable between 1.0 and 1.5 volts
Supply current	0.3 mA (0.5 mA under strong signal conditions)
Frequency range	150 kHz to 3 MHz useful range
Input resistance	4MΩ typical
Threshold sensitivity	400 μV/m at 1 MHz with recommended coil
Selectivity	– 6 dB bandwidth typically 8 kHz
Audio distortion	⩽ 2% T.H.D. under correct operating conditions
AGC range	> 30 dB (dependent on R_{AGC}); see graph 1
Output	5 to 30 mV dependent on applications
Power gain	72 dB typical

The value of the agc resistor may be varied; for most applications 1.5 kΩ represents the optimum value. For some earpiece circuits, where the operating requirements are somewhat different, 680 Ω gives better results.

If the value of the resistor is altered, note that the supply current for the ZN414 flows through it (typically 0.3 mA), and the supply voltage will also have to be changed.

$$V_{ZN414} = V_{supply} - 0.3\ R_{AGC}$$

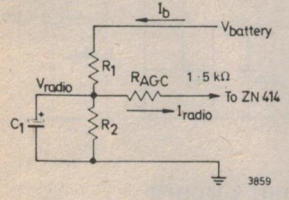
where

R_{AGC} is in kilohms

The voltage, and hence gain, of the ZN414 can be increased until instability results. A further gain increase, at the expense of audio quality, can be achieved by increasing the capacitor across the output and earth terminals from 0.22 μF up to a maximum of 0.8 μF.

Drive Circuits

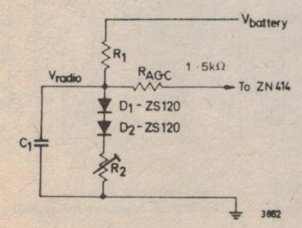
The ZN414 must be driven from a voltage source or agc performance suffers. There are several ways of achieving this; the following circuits have been found to be successful.



$V_{battery}$	R_1	R_2	C_1
1·3V cell	Run ZN414 Direct (470 Ω AGC)		
1·5V cell	Run ZN414 Direct (470 Ω AGC)		
3V	820 Ω	1 kΩ	⩾4·7 μF
4·5V	1·5 kΩ	1 kΩ	⩾3·3 μF
6V	2·2 kΩ	1 kΩ	⩾2·2 μF
9V	3·9 kΩ	1 kΩ	⩾1 μF
12V	5·6 kΩ	1 kΩ	⩾1 μF

1. POTENTIAL DIVIDER

The above circuit is simple and economical on components, but is rather wasteful of battery current, consuming 2 mA, for the 0.3 mA total consumed by the radio. However, for most applications this does not present any problems, but the circuit is affected by ageing batteries.



$V_{battery}$	R_1	R_2	C_1
1·3V	Run ZN414 Direct		
1·5V	Run ZN414 Direct		
3V	2·7 kΩ	500 Ω*	⩾1 μF
4·5V	3·9 kΩ	500 Ω*	⩾1 μF
6V	5·6 kΩ	500 Ω*	⩾1 μF
9V	8·2 kΩ	500 Ω*	⩾0·47 μF
12V	12 kΩ	500 Ω*	⩾0·22 μF

* Preset

2. DIODE SOURCE

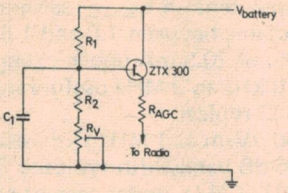
Although the voltage across two silicon diodes is adequate to drive the ZN414, unless the current through them is several milliamperes, the voltage will be rather low. The inclusion of R_2 solves the problem enabling the complete circuit to operate on about 1 mA, and the circuit shown will drive the radio almost independently of V_b. R_2 serves as a sensitivity control.

ETI data sheet

ZN414, IC Radio

3. TRANSISTOR DRIVE

By far the most elegant drive circuit is obtained by using a single transistor as a voltage source. This drives the ZN414 from a low impedance, and only consumes the current required to drive the radio (plus about 30 µA bias current). The circuit and table of component values is shown below. If R_2 is made a preset (or a fixed value and a preset as shown), then the voltage applied to the chip may be varied, thus providing a sensitivity control.

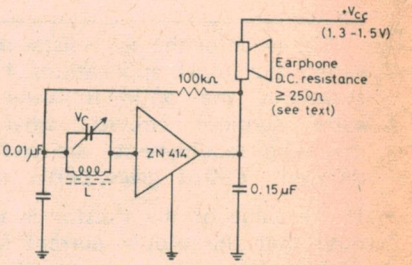


$V_{battery}$	R_1	R_2	R_V	C
1·3V	Run ZN414 Direct			
1·5V	Run ZN414 Direct			
3V	39 kΩ	68 kΩ	25 kΩ preset	0·1 µF
4·5V	100 kΩ	68 kΩ		
6V	150 kΩ	56 kΩ		
9V	220 kΩ	56 kΩ		
12V	330 kΩ	56 kΩ		

PRACTICAL RADIO CIRCUITS

Simple Earpiece Radio

Fig. 3. The circuit shown is a simple self-contained circuit. Providing the ferrite rod size is above 1" in length, the circuit will satisfactorily receive local broadcasts with adequate volume. A crystal earpiece may be used by connecting an agc resistor in place of the earpiece shown (250 to 680 Ω), and connecting the crystal earpiece between the positive supply and output pin of the ZN414.



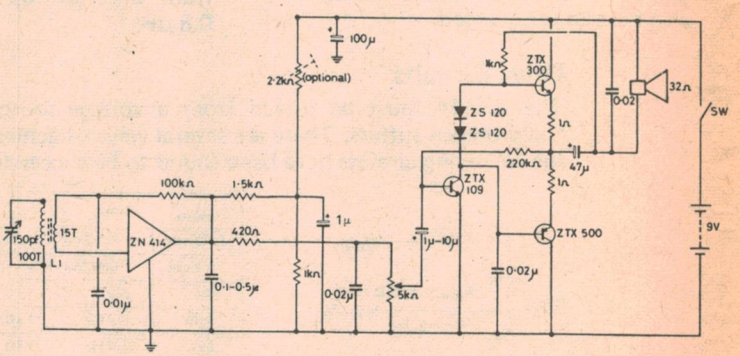
Personal Radio

Fig. 4. This circuit should consume 10 mA or less under quiescent conditions. Clearly, the choice of loudspeaker, audio amplifier and case can be varied considerably, providing the basic design rules concerning the ZN414 are followed.

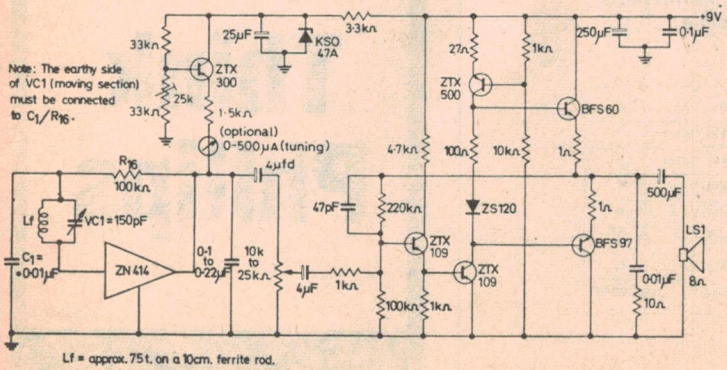
Using an audio IC enables a further size reduction to be made, but many of these devices give poorer sound quality than discrete versions. A choke may be needed in the input of an IC amplifier to prevent RF breakthrough.

The following results were obtained from prototype receivers:

Peak Sensitivity (at 1 MHz)	400 µV/m
−6 dB Bandwidth (at 1 MHz)	8 kHz
Audio sensitivity	300 µV
10% T.H.D. output	220 mW
Max output	340 mW
Distortion at 50 mW	3%



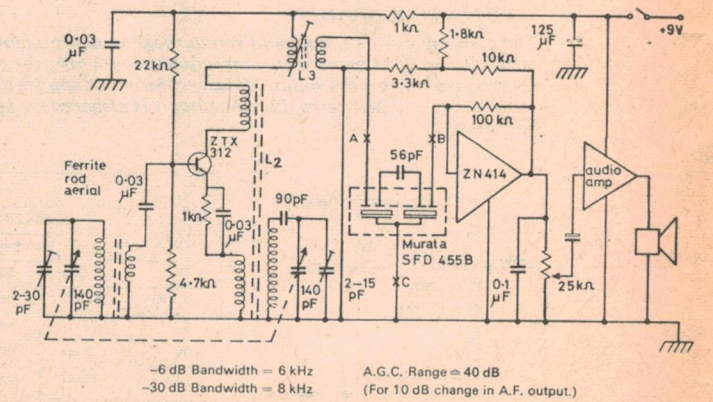
Domestic Radio



Lf = approx. 75t. on a 10cm. ferrite rod.

Fig. 5. Domestic Radio Circuit The audio stage is of high quality design, wholst retaining low current drain. The zener diode ensures that the receiver will function until the battery is incapable of driving the audio stage. An optional tuning meter ensures accurate station tuning.

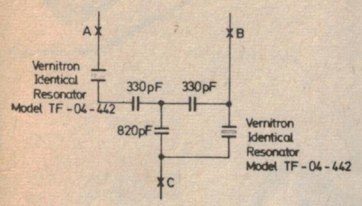
ZN414 in A.M. Superhet Circuits



−6 dB Bandwidth = 6 kHz
−30 dB Bandwidth = 8 kHz

A.G.C. Range ≏ 40 dB
(For 10 dB change in A.F. output.)

Fig. 6. If R_{AGC} is increased in value, the sensitivity of the ZN414 increases – higher supply voltages are needed to achieve this. Under these conditions (which are unsuitable for TRF receivers) the ZN414 gives excellent results as an IF amplifier working at 450-470 kHz. The ceramic resonator is recommended for these applications. The circuit shown is for a medium wave superhet receiver. The broadcast band superhet, although giving higher selectivity, is noisier than the ZN414 TRF designs and does not give

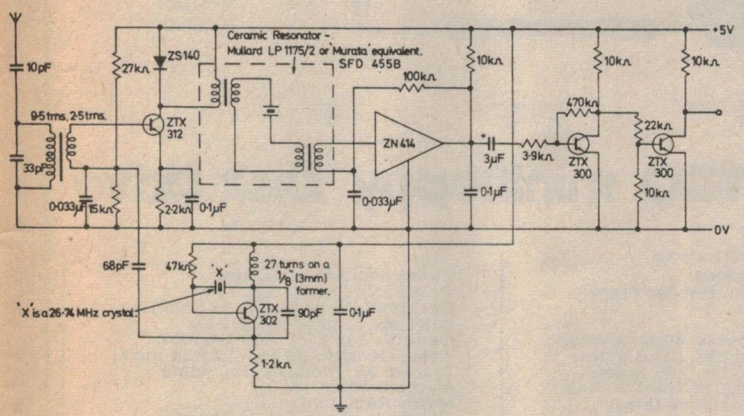


I.F. Bandwidth (–6 dB points) = 6·5 kHz
Insertion loss = 4·8 dB

Fig. 7. Alternative resonator system giving better noise figures.

as good audio quality. It is, however, recommended in applications where a TRF would be unsuitable (e.g. Crystal control with narrow bandwidths).

Radio Control Circuits



Tuned Aerial Circuit

Aerial coil: Primary 9·5 turns of 32 S.W.G. E.C.W. close wound.

Secondary 2·5 turns of 32 S.W.G. E.C.W. close wound.

Primary and secondary adjacent on a $\frac{3}{16}$" diameter (4·8 mm) former in screening can, with R.F. grade ferrite tuning core.

Any miniature I.F. transformer provided the former diameter is correct, should be satisfactory.

Oscillator coil:

27 turns of 35 S.W.G. E.C.W. close wound on a $\frac{1}{8}$" diameter (3 mm) former.

Suggested former is a high value Dubilier BTT resistor.

No screening required.

Fig. 8. The circuit shows a ZB414 used as an IF amplifier for a 27 MHz model control superhet receiver. Here the extremely small size and weight of the ZN414 is a great advantage.
Performance details:
Sensitivity = 2.5 μV for a 5 V pyp output measured at f_c = 27.21 MHz. 100% modulated with 100 Hz square wave.
Selectivity: ± 5 kHz for < 100 mV ptp output.
Input signal range: 2.5 μV to 25 mV (i.e. 80 dB).
Supply current: ~4.5 mA.

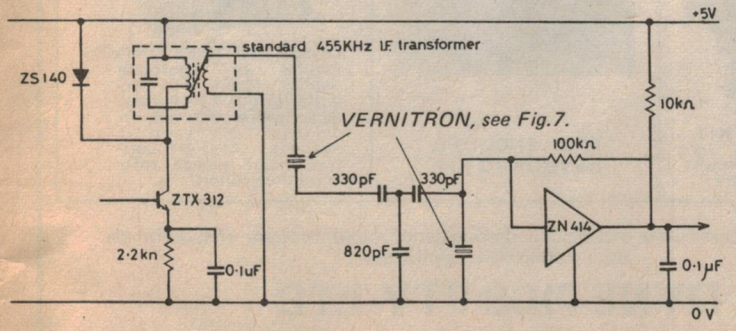


Fig. 9. Alternative resonator circuit.

Ideas for experimenters

These pages are intended primarily as a source of ideas. As far as reasonably possible all material has been checked for feasibility, component availability etc, but the circuits have not necessarily been built and tested in our laboratory. Because of the nature of the information in this section we cannot enter into any correspondence about any of the circuits, nor can we produce constructional details.
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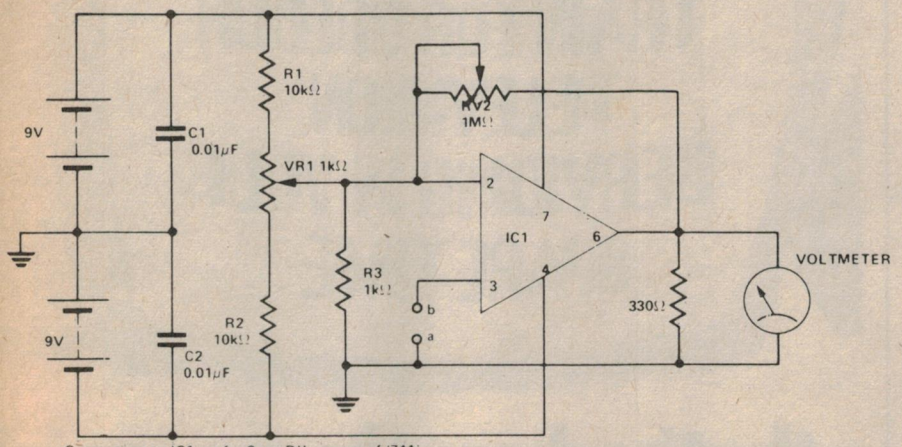
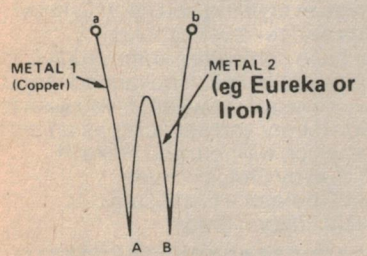


Connections to IC1 are for 8 pin DIL version of '741'

The circuit illustrated was devised to provide a low-cost, sensitive thermometer for measuring temperature differences. The transducer used is a thermocouple consisting of two wires of the same metal, often copper, joined at the two points A and B by a wire of different metal. This thermocouple pair generates a small voltage difference across the points A and B when a temperature difference exists between the junction a and b. This voltage varies almost linearly with temperature for differences up to about 100°C, although this assumption should not be made in calibrating the thermometer for accurate measurement.



A 741 is used (IC1) for amplifying the small voltage difference between the points a and b enabling a rugged voltmeter to be used to display the temperature difference. The potentiometer is used to set the meter to zero; values of 1 kΩ makes setting easy when measuring small temperature differences. However, it may prove necessary to adjust the value of R1 or R2 if zero setting cannot be obtained. If fairly large temperature differences are being measured, VR1 could be increased to 10 k.

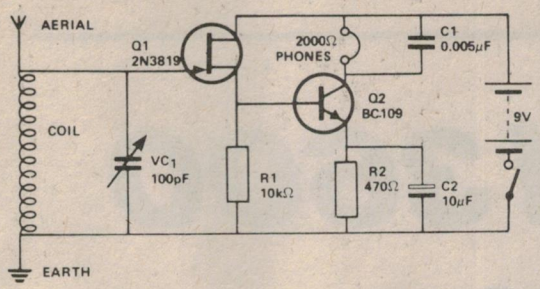
The sensitivity of the circuit is controlled by the full scale deflection of the voltmeter chosen, on the setting of (the voltage gain is the ratio VR2/R3), and on the choice of metals in the thermocouple. If the gain of the circuit is set high (at 1,000) electrical noise pick-up and drift become serious problems and it is advisable to assemble the circuit in a metal, earthed box and to ensure the unit is kept at constant temperature.

For best results, the power supplies should be stabilised and balanced. Capacitors C1 and C2 filter out any electrical noise on the power supply leads; if the thermocouple leads are long, a similar value capacitor across a and b should be used for the same reason.

Calibrated and use of the thermometer is carried out by immersing one junction in a liquid at a reference temperature, say melting ice, and using the other junction to monitor the changing temperature.

Ideas for experimenters

Field-effect transistor radio



The circuit shown in the figure provides a simple radio receiver which is both sensitive and selective. A low-cost FET is used — the JUGFET 2N3819.

In order to ensure that the impedance of the parallel tuned circuit is high at responance, the inductance of the coil should be high and the value of the tuning capacitor should be kept low.

The amplitude modulated carrier wave sets up a varying voltage across the tuned circuit which causes V_{CS} to vary and changing drain current I_{DS} to flow. A varying voltage is developed across R1 which is amplified by the non-bipolar transistor Q2. Capacitor C2 decouples the emitter of the bi-polar transistor to ground for ac signals and capacitor C1 decouples the radio frequency component of the signal from the phones.

Detection of the amplitude modulated carrier wave is achieved by operating Q2 close to the 'knee' of its transfer characteristic. If the receiver tends to be unstable, the tendency for it to break into oscillation can be reduced by coupling the aerial to the circuit by means of a 47 pF capacitor.

Reduced ripple at low current

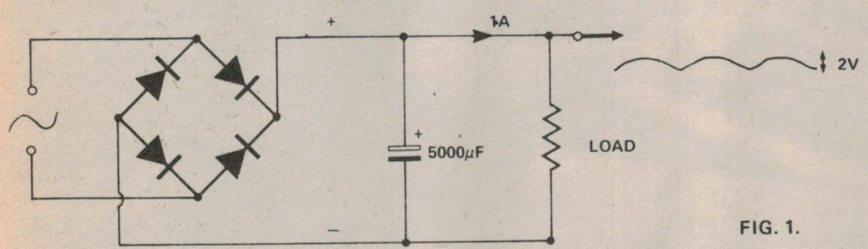


FIG. 1.

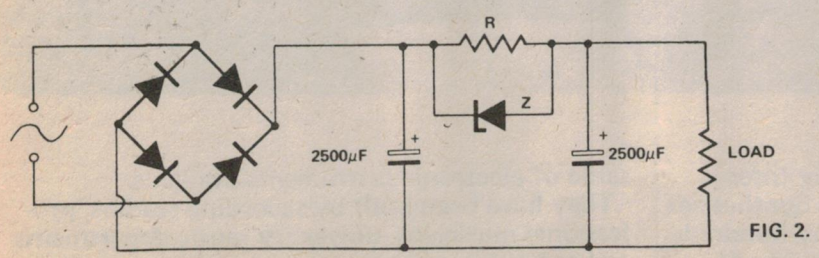


FIG. 2.

In the normal circuit (Fig. 1) the ripple at 1 amp is at least 2 volts. Cheap power amps use this circuit (with low supply ripple rejection) and produce annoying amounts of hum at low signal levels.

In the circuit in Fig. 2 the ripple is considerably reduced at low levels and at high currents the supply voltage is only minimally affected.

Maximum low ripple current (1m) = Vz/R where Ptot R must be more than Vz^2/R = 1m Vz. 1M = maximum total current so P_{tot} = 1M-1m Vz. A typical set of values for 1m = ½Amp is Vz = 3V, R = 1½ ohms.

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Computer Programming and Data Processing
General Computer Programming
Computer Systems Analysis
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Graduateship

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Automotive Mechanic
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Queensland 'B' Grade Motor Mechanic
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Air Conditioning and Refrigeration Technology
Drafting for Air Conditioning
Basic Air Conditioning and Refrigeration Technology
Commercial and Domestic Refrigeration and Air Conditioning Servicing
Domestic Appliance and Refrigeration Servicing
Air Conditioning Technology
Air Conditioning for Automobiles

Business Management
Institute of Business Administration Diploma in Management
Commercial Education Society of Australia — Diploma in Management
Industrial Management
Works Management
Personnel Management
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Small Business Owners
Modern Marketing Management
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Purchasing and Supply Management
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Pitman's Stenography
Gregg Stenography
Clerk-Typist
Gregg Shorthand with Speed Building
Gregg Speed Building
Pitman's Shorthand
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Typewriting

Interior Decorating
Interior Decoration Program

Photography
Photography Program

Creative Leisure
Dressmaking
Dressmaking and Pattern Cutting
Typewriting
Guitar

This list is correct at the time of submission for publication, and may vary.

ICS
International Correspondence Schools
400 Pacific Highway, Crows Nest N.S.W. 2065. Tel 432121
18-20 Collins Street Melbourne VIC 3000 Tel 637327
New Zealand 182 Wakefield Street, Wellington

PKB 54374 R

Please Explain

VCT

What does VCT actually stand for – the article in the January issue didn't say.

H.R., Sydney

VCT stands for Voltage-Current Transactor.

Gain Antennas

How can an antenna have gain? Surely it cannot be more than 100 percent efficient?

B.C., Wollongong, NSW

When an antenna is said to have 'gain' this doesn't mean you can get our more power than you put in. It means that, in certain directions, it radiates or receives more power than you would get from a standard antenna. The most common standard used to measure other antennas is the dipole. But the dipole has gain over some types – in its best direction it has 2.1 dB gain over an isotropic source (a point source radiating equal power in all directions).

You can get gain from certain antennas because they are designed to radiate less power in undesirable directions. There is not room here to study the radiation patterns of various types of antenna, but put simply the horizontal dipole radiates usefully in the two directions perpendicular to the antenna, and the vertical dipole is omnidirectional (it radiates equally to all points on the horizon).

To improve the directionality (and thereby the gain) of the horizontal dipole other elements (reflector and directors) can be added to make a 'beam' antenna.

To improve the gain of the vertical dipole without ruining its omnidirectional properties the radiation pattern has to be distorted to give more power in the horizontal plane and less in directions above or below it.

More information on antennas can be obtained from amateur radio handbooks.

Silly Standard?

In building one of your recent projects I had considerable difficulty deciphering your capacitor codes. No one else seems to be using codes like 3ns or 100n, why are you being so difficult?

S.B., Mosman, NSW

Early in 1976 we adopted British Standard BS1852 (1967) for marking components on circuit diagrams and in our parts lists. We think the new standard will, in the long term, make things easier for our readers. But, as with all new systems, the changeover period is a difficult time.

The main advantage of the new system is that it does away with the decimal point. This cuts down problems that occasionally arise in the process of putting our material into print – dots on the page result from some of the processes and these are later deleted by hand. (This means decimal points can be erroneously introduced or removed.) Another advantage is that numbers used are greater than one and multipliers are spaced at 10^3 intervals, in conformity with the metric system.

In Europe this standard is being used more and more and if other magazines are not using it yet we suggest it is because they are behind the times. Most Japanese and European (ie, Philips, Seimens, etc) components now carry these markings.

For those readers who are still wondering what 3n3 means in the old system, it was 0.0033 μF.

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7416	.35	7486	.40	74173	1.49
7417	.35	7489	2.25	74174	1.23
7420	.16	7490	.43	74175	.97
7422	.30	7491	.75	74176	.89
7423	.29	7492	.48	74171	.84
7425	.27	7493	.48	74180	.90
7426	.26	7494	.78	74181	2.45
7427	.29	7495	.79	74182	.79
7430	.20	7496	.79	74184	1.90
7432	.23	74100	.98	74185	2.20
7437	.25	74105	.44	74187	5.75
7438	.25	74107	.37	74190	1.15
7440	.15	74121	.38	74191	1.25
7441	.89	74122	.38	74192	.95
7442	.59	74123	.65	74193	.85
7443	.73	74125	.54	74194	1.25
7444	.73	74126	.58	74195	.74
7445	.73	74132	.89	74916	1.25
7446	.81	74141	1.04	74197	.73
7447	.79	74145	1.04	74198	1.73
7448	.79	74150	.97	74199	1.69
7450	.17	74151	.79	74200	5.45

LOW POWER

74L00	.29	74L51	.29	74L90	1.40
74L02	.29	74L55	.29	74L91	1.20
74L03	.23	74L71	.29	74L93	1.50
74L04	.29	74L72	.45	74L95	1.50
74L06	.29	74L73	.56	74L98	2.25
74L10	.29	74L74	.56	74L164	2.25
74L20	.29	74L78	.75	74L165	2.30
74L30	.29	74L85	1.09		
74L42	1.39	74L86	.65		

LOW POWER SCHOTTKY

74LS00	.36	74LS32	.38	74LS95	2.09
74LS02	.36	74LS40	.45	74LS107	.59
74LS04	.36	74LS42	1.40	74LS164	2.20
74LS08	.38	74LS74	.59	74LS193	2.20
74LS10	.36	74LS90	1.30	74LS197	2.20
74LS20	.36	74LS93	1.30		

HIGH SPEED

74H00	.25	74H22	.25	74H61	.25
74H01	.25	74H30	.25	74H62	.25
74H04	.25	74H40	.25	74H74	.39
74H08	.25	74H50	.25	74H101	.58
74H10	.25	74H52	.25	74H102	.58
74H11	.25	74H53	.25	74H103	.60
74H20	.25	74H55	.25	74H106	.72
74H21	.25	74H60	.25	74H108	.72

SCHOTTKY

74S00	.38	74S08	.52	74S22	.38
74S02	.45	74S10	.38	74S32	.52
74S03	.38	74S20	.38	74S74	.38
74S04	.45				

8000 (NATIONAL)

8091	.61	8220	1.49	8811	.65
8092	.61	8230	2.19	8812	1.02
8095	1.25	8288	1.49	8822	2.19
8121	.80	8520	1.16	8830	2.19
8123	1.43	8552	2.19	8831	2.19
8200	2.33	8563	.62	8836	.29
8214	1.49	8810	.70	8880	1.19

8000 (SIGNETICS)

8263	5.79	8267	2.59		

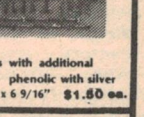
9000

9002	.40	9309	.79	9601	.61
9301	1.03	9312	.79	9602	.79

DVM CHIP 4½ DIGIT
MM5330 — P channel device provides all logic for 4½ digit volt meter. 16 pin DIP with data **$9.95**

IC BREADBOARD
Accommodates 5 16 pin IC's with additional interconnection holes. 1/16" phenolic with silver plated copper circuits. 2 5/16" x 6 9/16" **$1.50 ea.**

UNIVERSAL BREADBOARD
Silver plated copper circuit board 3-3/16" x 5-1/16". 2 rows of 27 holes for DIP IC's + space for transistors, resistors & capacitors. Versatile and simple for breadboarding IC circuitry **$1.50 ea.**



SHIFT REGISTERS

MM5013	1024 bit accum. dyn.	1.75
MM5016	500/512 bit dyn.	1.59
SL5-4025	Quad 25 bit	.99
2504	1024 bit multiplexed dyn	3.95

IC SOCKETS

Solder Tail - low profile

8 pin	$ .17	24 pin	.42
14 pin	.20	28 pin	.59
16 pin	.22	40 pin	.69
18 pin	.29		

WIRE WRAP - gold plate
14 pin .49

CMOS

4000A	.26	4018A	1.39	4066A	.89
4001A	.25	4020A	1.72	4068A	.44
4002A	.25	4021A	1.18	4069A	.44
4006A	1.35	4022A	.94	4071A	.26
4007A	.26	4023A	.25	4072A	.35
4008A	1.52	4024A	.89	4073A	.39
4009A	.57	4025A	.25	4075A	.39
4010A	.54	4027A	.59	4078A	.39
4011A	.29	4028A	.98	4082A	.35
4012A	.25	4030A	.44	4518A	1.56
4013A	.45	4035A	1.27	4528A	1.56
4014A	1.27	4040A	1.39	4585A	2.10
4015A	1.27	4042A	1.47		
4016A	.48	4049A	.59		
4017A	1.01	4050A	.59		
74C00	.19	74C74	1.04	74C162	2.49
74C02	.26	74C76	1.34	74C163	2.66
74C04	.44	74C107	1.13	74C164	2.66
74C08	.68	74C151	2.62	74C173	2.22
74C10	.35	74C154	3.15	74C195	2.26
74C20	.35	74C157	1.76	80C95	1.15
74C42	1.61	74C160	2.48	80C97	.96
74C73	1.04	74C161	2.49		

TANTALUM CAPACITORS

Solid dipped +20%

.1 mfd	35V	$ .25	10 mfd	16V	$ .40
.33 mfd	35V	.25	10 mfd	25V	.45
1 mfd	35V	.25	15 mfd	10V	.40
2.2 mfd	20V	.25	15 mfd	20V	.45
2.2 mfd	35V	.30	22 mfd	16V	.45
3.3 mfd	35V	.30	33 mfd	10V	.40
4.7 mfd	16V	.30	47 mfd	6V	.40
6.8 mfd	6V	.30	56 mfd	6V	.45
6.8 mfd	50V	.40	150 mfd	15V	.50

MEMORIES

1101	256 bit RAM MOS 16 pin	1.39
1103	1024 bit RAM MOS dynamic 18 pin	1.95
1702A	2048 bit PROM static electrically programmable UV erasable 24 pin	10.95
2102	1024 bit RAM static 16 pin	1.95
5203	2048 bit PROM static electrically programmable UV erasable 24 pin	10.95
5260	1024 bit RAM MOS dynamic 16 pin	1.95
5261	1024 bit RAM MOS dynamic 16 pin	1.95
7489	64 bit ROM TTL 16 pin	2.25
82S23	256 PROM-SCHOTTKY 16 pin	3.69
F93410	256 bit RAM bi-polar 16 pin	1.95
74187	1024 bit ROM TTL 16 pin	5.75
74200	256 bit RAM tri-state 16 pin	5.45

CLOCK CHIPS

MM5311	6 digit multiplexed BCD, 7 seg, 12-24 Hr, 50-60 He — 28 pin	4.45
MM5312	4 digit multiplexed BCD, 7 seg, lpps. 12-24 Hr. 50-60 Hz — 24 pin	3.95
MM5314	6 digit multiplexed 12-24 Hr, 50-60 Hz 24 pin	4.45
MM5316	4 digit, 12-24 Hr, 50-60 Hz, alarm 40 pin	4.95
15375AA	4-6 digit, 12 hour, 60 Hz snooze alarm brightness control capability, alarm tone output — 24 pin	4.95
CT7001	6 digit, 12-24 Hr, 50-60 Hz, alarm, timer and date circuits — 28 pin	6.95

CALCULATOR CHIPS

CT5002	12 digit, 4 function fixed decimal battery operation — 40 pin	1.95
CT5005	12 digit, 4 function plus memory, fixed decimal — 20 pin	2.49
MM5725	8 digit, 4 function, floating decimal 18 pin	1.98
MM5736	6 digit, 4 function, 9V battery operation — 18 pin	2.95
MM5738	8 digit, 5 function plus memory and constant floating decimal, 9V battery operation — 24 pin	3.95
MM5739	9 digit, 4 function, 9V battery operation — 22 pin	3.95

AUTO CLOCK KIT

- 6 digits .375" red led's
- Operates from 12V DC or AC
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- Contains internal 9V battery for operation of timing circuit (without display) when removed temporarily from power.
- Uses 5314 clock circuit
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1024 bit fully decoded static RAM DTL TTL compatible — 16 pin DIP $ 1.49

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8 digit multiplexed — five function — chain operation 2 key memory — floating decimal — independent constant — interfaces with led with only digit driver — 9 V batt. oper. 24 pin 2.95

7001 CLOCK CHIP

4-6 digit, 12-24 hr. alarm, timer and date circuits — with data **$5.95**

DVM CHIP 4½ DIGIT

MM5330 — P channel device provides all logic for 4½ digit volt meter. 16 pin DIP with data **$6.95**

FEBRUARY SPECIALS

LINEAR

301	Hi perf op amp	mDIP	.25
311	Hi perf V Comp	DIP	.71
555	Timer	mDIP	.39
565	Phase Locked Loop	DIP	.98
723	V Reg	DIP	.56
739	Dual Hi Perf Op Amp	DIP	.89
741	Comp Op Amp	mDIP	.26
1458	Dual Comp Op Amp	mDIP	.54
8864	9 DIG Led Cath Drvr	DIP	1.95
75150	Dual Line Driver	mDIP	1.52
75453	(351) Dual Periph. Driver	mDIP	.29
75491	Quad Seq Driver for LED	DIP	.62

TTL

7432	$ .19	7490	.39	74164	.85
7437	.20	74121	.29	74165	.85
7438	.18	74123	.49	74193	.73
		7474	.22	9602	.59

5314 CLOCK CHIP

6 digit multiplexed 7 segment output, fast; slow set, 24 PIN DIP **$3.95**

SPECIAL DEVICES

372	AF-IF Strip Detector DIP	2.93
546	AM Radio Receiver Subsystem DIP	.75
1310	FM Stereo Demodulator DIP	2.90
1496	Balanced Modulator-Demodulator	.99
1800	Stereo multiplexer DIP	2.48
ULN2208	FM Gain Block 34db (typ) mDIP	1.18
ULN2209	FM Gain Block 48db (typ) mDIP	1.35
2513	Character Generator 64x8x5 DIP-24	10.20
3046	Transistor Array DIP-14	.73

6 Digit Clock Kit

MM5314 with 6 NS71 .27" displays 2 P.C. boards — Display board may be remote. Internal or wall transformer can be used. 50-60 Hz, 12-24 hour. Includes all necessary transistors, resistors, capacitors, diodes, 3 switches and complete assembly instructions.

CK6-3 ..... **$14.95**

4 Digit Clock Kit

MM5312 and 4 NS71 .27" displays 12-24 hours, 50-60 Hz. One P.C. board accommodates clock, displays, and all necessary transistors, resistors, capacitors, diodes, 2 switches, complete instructions and schematics for assembly.

CK4-2 ..... **$10.95**

Mark I

A six digit clock kit with one double sided P.C. board accommodates MM5314 clock chip and 6 FND359 .375" displays. 12-24 hour, 50-60 Hz. Contains all necessary components, 3 switches and complete assembly instructions with schematics. Connections for remote displays.

Mark I **$13.95**

DISPLAYS

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MAN5	2.25
MAN6	2.49
MAN7	1.49
MAN8	2.25
MAN66	2.25
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FND500	1.89
NS71L	1.39

DISCRETE LED'S

ME4	$ .29
MV50	.12
NSL100	.12
NSL101	.12
NSL102	.15
MV5020	
RED	.15
GREEN	.15
AMBER	.15
CLEAR	.15

MULTIPLE DISPLAYS

NSN33	3 digit .12" red LED	1.79
HP5082-7405	5 digit .11 red LED	3.49
HP5082-7414	4 digit .11 red LED	3.25
SP-425-09	9 digit .25 gas disch.	1.79

OPTO ISOLATORS

MCD2	Opto isolator diode	1.09
MCT2	Opto isolator transistor	.70

LINEAR CIRCUITS

300	Pos V Reg (super 723) TO-5	$ .71
301	Hi Perf Op Amp mDIP TO-5	.29
302	Volt follower TO-5	.53
304	Neg V Reg TO-5	.80
305	Pos V Reg TO-5	.71
307	Op AMP (super 741) mDIP TO-5	.26
308	Mciro Pwr Op Amp mDIP TO-5	.89
309K	5V 1A regulator TO-3	1.35
310	V Follower Op Amp mDIP	1.07
311	Hi perf V Comp mDIP TO-5	.95
319	Hi Speed Dual Comp DIP	1.13
320T	Neg Reg 5, 12, TO-220	1.39
320K	Neg Reg 5.2, 12 TO-3	1.39
322	Precision Timer DIP	1.70
324	Quad Op Amp DIP	1.52
339	Quad Comparator DIP	1.58
340K	Pos V reg (5V, 6V, 8V, 12V, 15V, 18V, 24V) TO-3	1.69
340T	Pos V reg (5V, 6V, 8V, 12V, 15V, 18V, 24V) TO-220	1.49
372	AF-IF Strip detector DIP	2.93
373	AM/FM/SSB Strip DIP	2.42
376	Pos V Reg mDIP	.68
380	2w Audio Amp DIP	1.30
380-8	.6w Audio Amp mDIP	1.25
381	Lo Noise Dual preamp DIP	1.75
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556A	Dual 555 Timer DIP	1.19
560	Phase Locked Loop DIP	3.39
562	Phase Locked Loop DIP	3.39
565	Phase Locked Loop DIP TO-5	1.18
566	Function Gen mDIP TO-5	1.95
567	Tone Decoder mDIP	1.95
709	Operational AMP TO-5,or DIP	.26
710	Hi Speed Volt Comp DIP	.35
711	Dual Difference Compar DIP	.26
723	V Reg DIP	.62
733	Diff. video AMPL TO-5	.89
739	Dual Hi Perf Op Amp DIP	1.07
741	Comp Op Amp mDIP TO-5	.32
747	741 Dual Op Amp DIP or TO-5	.71
748	Freq Adj 741 mDIP	.35
1458	Dual Comp Op Amp mDIP	.62
1800	Stereo multiplexer DIP	2.48
3900	Quad Amplifier DIP	.49
7524	Core Mem Sense AMPL DIP	.71
7525	Core Mem Sense AMPL DIP	.90
8038	Voltage contr. osc. DIP	4.25
8864	9 DIG Led Cath Drvr DIP	2.25
75150	Dual Line Driver DIP	1.75
75451	Dual Perepheral Driver mDIP	.35
75452	Dual Peripheral Driver mDIP	.35
75453	(351) Dual Periph Driver mDIP	.35
75491	Quad Seq Driver for LED DIP	.71
75492	Hex Digit driver DIP	.80

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SELL: Educ 8 Computer, working order, room for expansion, suit experimenter. $400. K. Schiesser, 89 Darebin Boulevard, Reservoir, 3073, Melbourne, Vic. 46-4003.

ASCII Flexowriter/punch/reader with desk and arithmetic unit $190. Baudot Flexowriter $70. Creed 7B $50. John Monro, 16 Gourlay Street, Balaclava, Vic. 527-1075.

MAGAZINES old and new electronic UFO, the lot. Contact Michael Kottek, 9 Stirling Crescent, Glen Waverley, 3150, Melbourne. Phone 520-3434.

AMPEX 1100, 2100 series recorder wanted as parts for own machine. Write McMahon, Mason Street, Rockhampton, 4701. Phone 28-2428, will pay top price.

WANTED to buy/borrow instruction book(s) for Corvus 500 calculator. Will pay for photostats. Peter Duckworth, 11A Ormond Espl., Elwood, Vic. 3184. Ph: 91-4728, 5.30pm — 6.30pm.

WANTED to buy. ETI Oct, Nov, Dec. 1973. M. Davis, 88 Helena St, Guildford, West Aust. Ph: 79-5149, will collect.

ORGAN FARFISA "Matador M.R." Single manual, inbuilt rhythm, amp, speakers, manual bass., fully portable. Costs $550. Sell new $300. Morrow, 52 Morotai Av, Ashburton, Melbourne.

ELECTRONIC watch timer with print out. Suits all clocks, watches, partly dismantled. All items incl. data circuit diagrams etc. $80 o.n.o. C. Joyce, Box 363, Tamworth 2340.

FILMS, Sound Mag. opt. Sale/Exchange, Halpin 81-4724 Vic. 3122, 12 Swinburne Ave., Hawthorne.

MELBOURNE tape friends. THE RECORDING SOCIETY OF AUSTRALIA meets monthly for lectures and demonstrations. For further information and syllabus ring (AH) (03) 459-1717 or (03) 99-4185.

HEWLETT PACKARD HP-65A fully programmable pocket calculator & accessories including software — Standard, Maths I, Maths II, Statistics & Electrical Engineering I program packages. Phone Adelaide 42-2065 for details.

FOR SALE: B&K 960 tr. Analyst, B&K 1076 TV Analyst, AWA, 4A56036 Sweep G., 1A56057 TV Calibr. Marconi TF1064B/5, Leader LSG-11, Tech Tube tester. Offers to PO Box 533, Albury 2640 NSW.

WANTED circuit for a voice operated morse code transmitter and radio receiver freq 0.2.5m. Write to Theo Farrell, c/- PO Box 18, Thorn. Victoria 3071.

TELETYPE model 15 P/printer $80; Model 14 RX typing reperf. $40.; TX. dist. $45; Hi speed punch $30; P. Hassett, 54 Sackville St, Maroubra (02) 34-6179.

WANTED: copy of circuit for AR7 receiver and power unit. Robert Chester, 12 High Street, Cheltenham, S.A. 5014.

HELP WANTED checking ASCII — Beaudot translator. Lack of equipment and knowledge hindering. Chris Owen, 23 Clifford St, Dover Gardens, S.A. Ph: 298-4072.

EXTENSIVE private stock, new components for sale, all ½ price, incl. 1% Hi-stab resistors, polystyrenes, electro's, polyesters, pots, transformers, 2 pin sockets. J. Korczynski, 50 Robb St, Essendon, Victoria 370-4520.

FOR SALE: ETI 4600 synthesizer partially completed. Any offers considered. Contact Glenn Block, 19 Forfar Rd, Hamlyn Heights, Geelong 3215, Vic.

FOR SALE: Rotel RA-211 amplifier, 12 wrms per channel. Very good condition, $75 o.n.o. Chris Mooney, 12 Jamieson Avenue, Fairlight, NSW (Sydney). Phone 949-2931.

WANTED: CRO 5 MHz or more, also 2M FM transceiver, any condition considered. A. Ohsberg, VK62AO, PO Box 178, W.A. 6009. Phone (092) 26-6587.

SELL TRIO 9R-59DS communications receiver. 5—30 MHz coverage. Electrical bandspread on ham bands. Hardly used. $120. R. Duncan, 18 Foxall St, Holder, A.C.T. Phone 88-3481.

TELEVISION CAMERA RCA/TK32 B&W/CCIR Synch. Gen/Monitor/Reg. Power Supply/Cabling/Handbooks Ex Ch. 2 News $500. Fitzpatrick, 5 Koala Close, St. Ives, Sydney 44-3878.

SCIENTIFIC AMERICAN. Full set 1973. Very good condition $10 including rail freight. P. Birrell, Box 261, Mt. Gambier 5290.

NEW FREQUENCY Counter, NET C32 in box with manual, accessories, $150. Any offers accepted. Michael Stevenson, "Attunga", RMB59, Harden, NSW, 2587. Phone (AH) 86-8201.

MICROPROCESSOR N.S. SC/MP fully assembled, tested and working. TTY cable. Full documentation. $65.00, Don Annett, 22 Trafalgar Road, Camberwell, Vic. (03) 82-7288.

MOOD COLOUR 4, as purchased from Kitsets, came without circuit or component layout. Will pay for photocopy and P&P. D. V. Robinson, VK6TZ, 26 Chelsfield St, Gosnells, WA (092) 96-1592.

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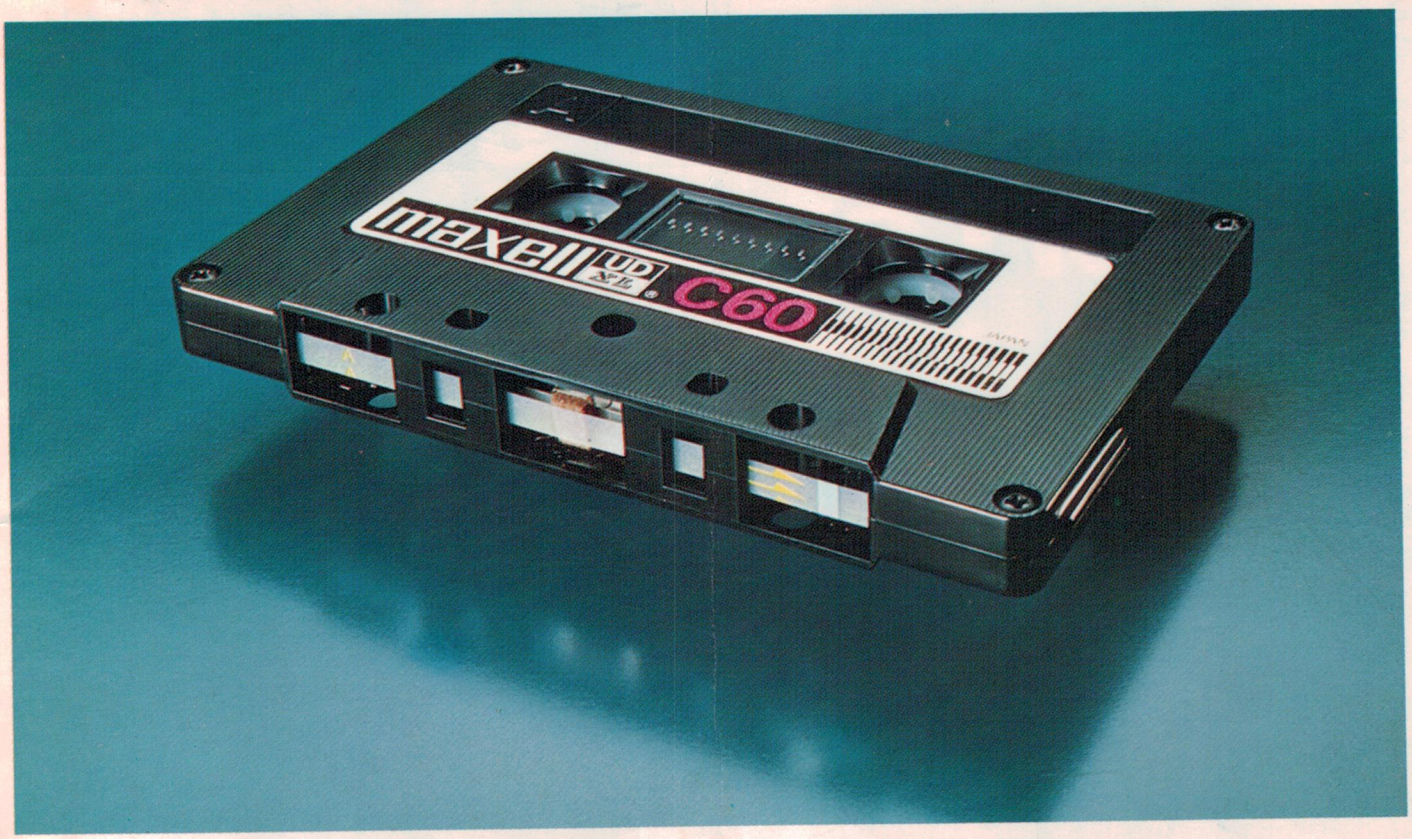

Introducing the revolutionary UD-XL EPITAXIAL cassette

UD XL

Developed by MAXELL this completely new EPITAXIAL magnetic material combines the advantages of the two materials (gamma-hematite and cobalt-ferrite): the high sensitivity and reliable output of the gamma-hematite in the low and mid-frequency ranges and the excellent performance of the cobalt-ferrite in the high-frequency range. The result is excellent high-frequency response plus wide dynamic range over the entire audio frequency spectrum.

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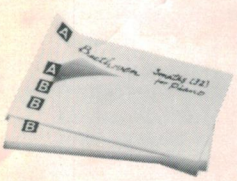
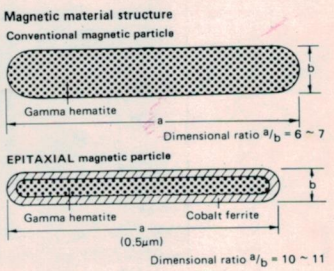
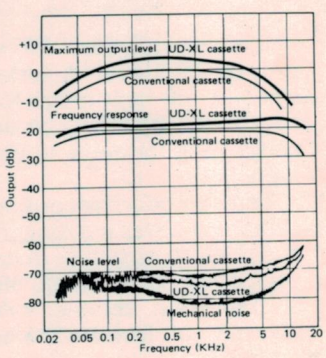
Fidelity is also ensured by a precision-manufactured cassette shell with a special anti-jamming rib that provides smooth tape travel and helps eliminate wow and flutter.



Another good idea of the UD-XL cassette is a replaceable self-index label. Simply peel off the old label and put on a new one when you change the recording contents. No more mess on the label.





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CS-911A

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	Maximum input power	Enclosure type	Speaker units (Type)			Frequency range
			Woofer	Mid-range	Tweeter	
CS-911A	150W	Bass reflex bookshelf	15 inch cone (38cm)	4 inch cone x 2 (10cm)	3 inch cone (7.7cm) 2-1/4 inch cone x 2 (5.7cm) (Supertweeter)	25 – 22,000Hz
CS-811A	120W	Bass reflex bookshelf	12 inch cone (30cm)	4 inch cone x 2 (10cm)	3 inch cone (7.7cm) 2-1/4 inch cone (5.7cm) (Supertweeter)	30 – 22,000Hz
CS-711A	100W	Bass reflex bookshelf	12 inch cone (30cm)	4-3/4 inch cone (12cm)	2-5/8 inch cone (6.6cm)	30 – 20,000Hz
CS-511A	70W	Bass reflex bookshelf	10 inch cone (25cm)	3 inch cone (7.7cm)		35 – 20,000Hz

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